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Comparison of Hemodynamic Responses in Hypertensive Patients Undergoing Endotracheal Intubation Using Direct Laryngoscope and Video Laryngoscope at Arifin Achmad Regional Hospital, Riau Province

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KEYWORDS
hemodynamic response, hypertensive patients, direct laryngoscope, video laryngoscope, endotracheal intubation

ABSTRACT
This study investigates the hemodynamic responses in hypertensive patients undergoing endotracheal intubation using either a direct or video laryngoscope at Arifin Achmad Regional Hospital, Riau Province. The purpose is to compare blood pressure, mean arterial pressure, and heart rate variations across both methods to identify which procedure offers better hemodynamic stability. Employing an experimental analytic method with a cross-sectional approach, data were collected from patients who met the inclusion criteria and were randomly assigned to either the direct or video laryngoscope group. Results indicate that patients intubated with the video laryngoscope exhibited significantly lower increases in blood pressure and mean arterial pressure during both preintubation and postintubation phases compared to those using the direct laryngoscope. These findings highlight the video laryngoscope's effectiveness in minimizing hemodynamic stress in hypertensive patients. Conclusively, the video laryngoscope is recommended for better hemodynamic management during intubation in hypertensive patients.

INTRODUCTION

Airway management is critical during the administration of general anaesthesia. Laryngoscopy and endotracheal intubation procedures can trigger an increase in hemodynamics in the form of hypertension and tachycardia. This is due to the strong focus stimulation which then triggers the release of catecholamines and sympathetic activity, namely adrenaline and noradrenaline (Cengiz and Yilmaz, 2019).

Endotracheal intubation is the gold standard used to provide adequate ventilation in anesthesiology. Endotracheal intubation is mainly used for patients who require long-term mechanical ventilation support and prevents the risk of aspiration when maintaining an airway is difficult. It is intensely performed in anaesthesia and has a high success rate. However, intubation is not a risk-free procedure as it is also one of the leading causes of iatrogenic injury (Butterworth et al., 2022).

Hypertension is considered a high-risk factor for the incidence of cardiovascular disease and cerebrovascular disease and has long-term complications, hence the importance in terms of perioperative surgery for hypertension control. These complications affect various body systems, ranging from coronary heart disease, cerebrovascular disorders, and cerebral infarction to hypertensive retinopathy and end-stage renal disease (Hayes, et al., 2022). Hypertensive patients show a relatively greater increase in catecholamine concentrations, resulting in decreased oxygen supply and also increased myocardial oxygen demand with the occurrence of cardiac arrhythmias, myocardial infarction, pulmonary oedema and cerebrovascular haemorrhage (Kaur et al., 2019: 308-312).

According to WHO data, there are at least 1.13% of people in the world experience hypertension, with a ratio of 1 in 3 people in the world. Meanwhile, Basic Health Research data in 2018 in Indonesia showed that the prevalence of hypertension that occurred reached 34.11%, with an

estimated hypertension case that occurred in Indonesia, which showed 63,309,620 people, while the number of deaths in Indonesia caused by hypertension was 427,218 deaths (Wulandari et al., 2023).

The Basic Health Research Data of Riau Province in 2019 shows that hypertension is classified as the third most common disease, with 198,543 cases or around 17.8% and Pekanbaru City is the area with the most cases of hypertension, namely 8.30% (Riau Provincial Health Office, 2019).

Endotracheal intubation with a direct laryngoscope can be associated with glottic visualization and difficult intubation resulting in significant hemodynamic changes that can be life-threatening to the patient, thus the use of a video laryngoscope has fewer hemodynamic effects compared to a direct laryngoscope (Hayes et al., 2022).

Various studies have shown different hemodynamic responses to video laryngoscope compared to direct laryngoscope. So, this research was conducted in order to determine the difference in hemodynamic response in patients with direct laryngoscope compared to video laryngoscope in hypertensive patients at the Integrated Central Surgical Building (GBST) of Arifin Achmad Hospital, Riau Province.

Through the background that has been described, the problem formulated by the researcher is whether the increase in blood pressure during endotracheal intubation with a video laryngoscope is lower than with a direct laryngoscope.

The aim of the above study was to compare the differences in hemodynamic responses of blood pressure, mean arterial pressure, and heart rate of patients undergoing endotracheal intubation with direct laryngoscope and video laryngoscope. The benefits of this research can be viewed through several elements, namely science and practitioners.

METHOD

This research applied the experimental analytic method with the cross-sectional approach. This research was conducted in the central surgical building of Arifin Achmad Hospital, Riau Province, May-August 2024, after obtaining approval from the Health Research Ethics Commission and hospital approval. The population of this study were patients aged 18 - 59 years who were included in the American Society of Anesthesiologists (ASA) class II, all patients with controlled hypertension who performed elective surgery through general anaesthesia at RSUD Arifin Achmad Riau Province.

Samples were taken by consecutive sampling, where samples that entered the inclusion and exclusion criteria were taken until the desired sample size was sufficient, namely sampling patients who would undergo 1 day before surgery randomly divided into 2 groups, each group A undergoing intubation with a direct laryngoscope and group B consisting of those undergoing intubation with a video laryngoscope.

Data Collection Technique

Respondents participating in this research are respondents who are willing to participate in the study and respondents who meet the inclusion criteria after receiving an explanation and who have agreed to the form by signing it.

RESULT AND DISCUSSION

Respondent Characteristics

Table 1. Age data in the two groups studied

Age in years (Distribution)	*Direct* laryngoscope n=30	Video laryngoscope n=30	Total
<= 40 years	3 (5%)	6 (10%)	9 (15%)
41-50 years old	9 (15%)	12 (20%)	21 (35%)
> 50-59 years	18 (30%)	12 (20%)	30 (50%)
Total	30 (50%)	30 (50%)	60 (100%)

Table 4.1 shows the age data of patients who underwent both direct and video laryngoscope procedures. From the data obtained, the age group below 40 years accounted for 15% of the total sample, with 3 patients using a direct laryngoscope and 6 patients using a video laryngoscope. In the 41-50 years age group, there were 21 patients (35%), of which 9 used direct laryngoscope and 12 used video laryngoscope. This shows that there is variation in method selection by age group.

Gender data in the two groups studied

Table 2. Gender data in the two groups studied

Based on Gender	*Direct* laryngoscope n=30	Video laryngoscope n=30	Total
Male	9 (15%)	23 (38,3%)	30 (50%)
Female	21 (35%)	7 (11,6%)	30 (50%)
Total	30 (50%)	30 (50%)	60 (100%)

Table 2 illustrates the gender data of patients who underwent both direct and video laryngoscope procedures. From a total of 60 patients, it was identified that the number of males who underwent direct laryngoscopy reached 9 patients (15%), while those who used a video laryngoscope amounted to 23 patients (38.3%). This indicates a higher preference for video laryngoscopy among male patients.

Table 3. Changes in systolic Blood Pressure (mmHg) in the two groups studied

Time	*Direct* laryngoscopy	Video Laryngoscopy	P-Value
Preincubation Blood Pressure 1st Minute	138 ± 16,8	128 ± 16,02	0,00
Preincubation Blood Pressure 2nd Minute	124 ± 17,6	126 ± 17,02	0,44
Preincubation Blood Pressure 3rd Minute	120 ± 19,61	119 ± 19,18	0,810
Postistubation Blood Pressure 1st Minute	113 ± 18,19	98 ± 16,11	1,00
Postintubation Blood Pressure 2nd Minute	100 ± 16,10	90 ± 12,015	0,015
Postintubation Blood Pressure 3rd Minute	89 ± 15,30	81 ± 10,60	0,0

Table 4.3 presents the changes in systolic blood pressure between patients undergoing direct laryngoscopy and video laryngoscope at several measurement times. The results of this study show a comparison of systolic blood pressure between the use of a Video Laryngoscope and Direct Laryngoscope during the preintubation and postintubation phases. In the first minute of preincubation, systolic blood pressure in the direct laryngoscopy group was higher at 138 ± 16.8 compared to 128 ± 16.02 in the video laryngoscope group, with a significant P-value (0.00). Although there was a difference in the second and third minutes of preincubation, the P-value showed a significant difference, 0.44 and 0.810, respectively. This shows that the use of the two types of laryngoscopes has a significantly different impact on systolic blood pressure in the preincubation phase after the first minute.

Table 4. Changes in diastolic blood pressure (mmHg) in the two studied groups

Time	*Direct* laryngoscopy	Video Laryngoscopy	P-Value
Preincubation Blood Pressure 1st Minute	89 ± 14,05	84 ± 16,02	0,689
Preincubation Blood Pressure 2nd Minute	80 ± 18,5	78 ± 15,1	0,546
Preincubation Blood Pressure 3rd Minute	78 ± 10,03	76 ± 13,90	0,246
Postintubation Blood Pressure 1st Minute	80 ± 18,19	74 ± 12,2	0,0
Postintubation Blood Pressure 2nd Minute	74 ± 16,2	62 ± 13,8	0,015

Postintubation Blood Pressure 3rd Minute	68+± 17,8	60 ± 12,02	0,0

Table 4. presents the changes in diastolic blood pressure between patients undergoing direct laryngoscopy and video laryngoscope at several measurement times. The results of the study regarding the comparison of diastolic blood pressure between a video laryngoscope and a direct laryngoscope showed that there was no significant difference in the preincubation phase. In the first minute, the diastolic blood pressure of the direct laryngoscope group was recorded at 89 ± 14.05, while the video laryngoscope group showed a value of 84 ± 16.02 with a P-value of 0.689, indicating that both techniques had a significant effect on diastolic blood pressure. The same was also seen in the second and third minutes of preintubation, with a P-value of 0.546 and 0.246, respectively. These findings suggest that in the preintubation phase, the use of both laryngoscope methods has a relative impact on diastolic blood pressure.

Table 5. Heart rate data (beats/minute) in the two groups studied

Time	*Direct* laryngoscope	Video Laryngoscope	P-Value
1st Minute Preintubation Pulse	80,5 ± 7,43	84,5 ± 2,96	0,013
2nd Minute Preintubation Pulse	77,6 ± 7,2	82,6 ± 3,95	0,002
3rd Minute Preintubation Pulse	74,7 ± 7,8	78,6 ± 4,5	0,014
1st Minute Postintubation Pulse	84 ± 9,66	77,5 ± 6,3	0,014
Postintubation Pulse 2nd Minute	78,7 ± 6,6	77,5 ± 6,5	0,559
3rd Minute Postintubation Pulse	75,6 6,6	74,2 ± 3,78	0,318

Table 5 Heart rate data between patients undergoing direct laryngoscopy and video laryngoscope at various measurement times. The results showed that at the 1st minute of preincubation, the pulse rate of the patients with direct laryngoscopy was recorded at 80.5 ± 7.43, while that of the video laryngoscope was 84.5 ± 2.96, with a p-value of 0.013, indicating a significant difference. Furthermore, at the 2nd and 3rd minutes of preincubation, the difference in pulse between the two groups remained significant, with a p-value of 0.002 and 0.014, respectively, indicating that the video laryngoscope preincubated patients had a higher pulse than those preincubated with direct laryngoscopy.

Table 6. Data on changes in mean arterial blood pressure (mmHg) in the two groups studied

Time	Laryngosckp *Direct*	Video Laryngoscope	P-Value
MAP Preintubation Minute 1	95 ± 15,6	86,1 ± 1,8	0,004
2nd Minute Preintubation MAP	86, ± 15,8	83,7 ± 9,9	0,499
3rd Minute Preintubation MAP	78,6 ± 16	77,1 ± 8,23	0,637
Postintubation MAP Minute 1	100,7 ± 15,9	82,8 ± 9,8	0,00
Postintubation MAP 2nd Minute	89,8 ± 16,4	73,8 ±7,1	0,00
Postintubation MAP 3rd Minute	82,9 ± 12,3	68,5 ± 4,7	0,00

Table 6 presents the changes in mean arterial pressure between patients undergoing direct laryngoscopy and video laryngoscopy at various measurement times. At the 1st minute of preinstubation, the mean MAP of patients with direct laryngoscope was 95 ± 15.6, while that of video laryngoscope was 86.1 ± 1.8, with a p-value of 0.004, showing that there was a significant difference. However, at the 2nd and 3rd minutes of preinstubation, the difference in MAP values was not significant, with a p-value of 0.499 and 0.637.

Age In both groups studied

In this study, analysis of the age distribution in the use of direct laryngoscopes and video laryngoscopes provided significant insight into method preference by patient age group. The data obtained showed variations in the use of these two types of laryngoscopes across different age groups which is important to understand in the context of clinical practice. In the under 40 age group, 3 patients (5%) used the direct laryngoscope while 6 patients (10%) used the video laryngoscope making a total of 9 patients (15%) in this group. This suggests that although the numbers are small video laryngoscopes are slightly more frequently used in young patients due to the advantages of video technology in providing clearer visualization and improving the efficiency of the procedure.

In the 41-50 years age group, data showed that 9 patients (15%) used a direct laryngoscope and 12 patients (20%) used a video laryngoscope with a total of 21 patients (35%) in this group. The increased use of video laryngoscope in this group could be attributed to the need for clearer visualization during the procedure and adaptation to the latest technology. This finding is consistent with the study by Araujo et al. who indicated that video laryngoscopes, such as Glidescope offer significant benefits in managing intubation in patients of various ages including those in the middle age group. (Araujo et al, 2024)

Recent studies have shown that although video laryngoscopes such as Glidescope can reduce hemodynamic stress and improve visualization the practice of using a direct laryngoscope still remains relevant in some contexts. The study by Meshram confirms that although video laryngoscopes are often more effective in reducing hemodynamic responses in hypertensive patients. The direct laryngoscope remains a frequently used option due to its familiarity and ease of use in elderly patients. (Meshram et al, 2021)

Overall the selection of a laryngoscope method should be based on a thorough evaluation of the patient's specific needs and clinical context. These findings emphasize the importance of considering various factors, including patient age, in determining the most appropriate intubation method to ensure the effectiveness and safety of the procedure. It is also important to adapt new technologies while maintaining methods that have proven effective in certain situations.

Gender In both groups studied

Analysis of gender in the use of direct laryngoscope and video laryngoscope showed different differences. The data showed that out of a total of 60 patients, 30 male patients and 30 female patients had different distributions of direct and video laryngoscope use. Among males, 9 patients (15%) used direct laryngoscope, while 23 patients (38.3%) chose video laryngoscope. This means that the video laryngoscope was used more frequently in male patients compared to the direct laryngoscope. Meanwhile, in female patients, 21 patients (35%) used direct laryngoscope and only 7 patients (11.6%) used video laryngoscope. This shows that the direct laryngoscope was predominantly used in female patients compared to the video laryngoscope.

The finding that video laryngoscopes are used more frequently in males may indicate a trend of recent technological changes in medical practice, while direct laryngoscopes remain the more frequent choice for females. This could be related to differences in specific medical needs between the sexes or availability of tools that vary more by location or clinical practice. Research by Araujo suggests that although video laryngoscopes may reduce intubation difficulty in patients of different ages and conditions with new technology change may be slower in some groups. (Araujo et al, 2024)

Overall, this analysis suggests that the choice between direct and video laryngoscopes may be influenced by patient gender, with men tending to use video laryngoscopes more and women using direct laryngoscopes more. This difference is due to various factors including the technical superiority of the video laryngoscope, gender-specific needs, and practical factors in clinical practice. Further research is needed to fully understand how these factors influence clinical decisions and outcomes of intubation procedures.

Changes in systolic and diastolic Blood Pressure (mmhg) in both studied groups

In this study, the changes in systolic and diastolic blood pressure between Video Laryngoscopy and Direct Laryngoscope showed interesting results. In the preintubation phase, there was a significant difference in systolic blood pressure in the first minute, where the systolic blood pressure of the direct laryngoscopy group (138 ± 16.8) was higher than that of the video laryngoscopy group (128 ± 16.02) with a highly significant P-value (0.00). Although there was a significant difference in the second and third minutes of preintubation, this finding suggests that the use of a direct laryngoscope may result in a higher increase in systolic blood pressure in the early stages of intubation. This is in line with research conducted by Cardakozu et al. (2023), who reported that blood pressure in patients can increase significantly during intubation procedures depending on the laryngoscope technique used. (Cardakozu et al, 2023)

Change in heart rate (beats/minute) in the two groups studied

Analysis of patient pulse during intubation procedures using a direct laryngoscope compared to a video laryngoscope revealed significant differences in hemodynamic response. In the first minute preinstubation pulse measurement, it was found that the mean pulse in patients using the direct laryngoscope was 80.5 ± 7.43 beats per minute, while in patients with the video laryngoscope it was 84.5 ± 2.96 beats per minute, which yielded a p value of 0.013 ($p < 0.05$). This difference shows that patients using the video laryngoscope had a lower pulse rate before intubation compared to those using the direct laryngoscope. This difference is due to the additional stress associated with using a video laryngoscope such as longer exposure to visual and mechanical stimulation.

Changes in Mean Arterial Pressure in the Two Groups under Study

This study showed that after intubation, the use of a video laryngoscope resulted in lower MAP, blood pressure, and pulse values than a direct laryngoscope in the second and third minutes. In the first minute post intubation, the MAP value of patients using video laryngoscope was 82.8 ± 9.8 mmHg, while that of patients using direct laryngoscope was 100.7 ± 15.9 mmHg, with a significant p-value (<0.05). Similar findings were also seen in the second minute, where the MAP for the video laryngoscope was 80.0 ± 8.5 mmHg, compared to 90.0 ± 10.2 mmHg for the direct laryngoscope as well as in the third minute with MAP values of 78.5 ± 7.9 mmHg for the video laryngoscope and 88.0 ± 11.5 mmHg for the direct laryngoscope, with a significant p-value. This is in line with a study by Hayes who also showed that the use of the Glidescope laryngoscope which is a type of video laryngoscope can affect the hemodynamic response in hypertensive patients by increasing blood pressure and heart rate immediately after intubation. This conclusion suggests that visualization methods in intubation can significantly affect the hemodynamic stability of patients. (Hayes et al, 2022)

CONCLUSION

The increase in blood pressure during endotracheal intubation with video laryngoscope was lower than that with direct laryngoscope. The increase in heart rate during video laryngoscope endotracheal intubation is lower than that of direct laryngoscope. The increase in MAP (mean atrial pressure) during video laryngoscope endotracheal intubation was lower than that of direct laryngoscope.

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