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Comparison of Hemodynamic Response to Laryngoscopy / Intubation: Intravenous Lidocaine vs Repeat Dose Propofol

Muhammad Salman Maqbool, Hasnain Ameer Hamza, Fahad Zubair, Kainat Irshad, Affifa Saleem

ABSTRACT:

Objectives: The contrast of effectiveness of repeat dose propofol with lidocaine efficacy before laryngoscopy in maintaining stable hemodynamic(pulse and mean blood pressure)pressure values following endotracheal intubation.

Study design and setting: Randomized controlled interventional(purposive sampling) study by the Anesthesia Department at Farooq Hospital Islamabad, ASMC (Rwp)from 21-06-2024 to 04-10-2024.

Methodology: The study was authorised by the Research Committee; Akhtar Saeed Medical College, Rawalpindi on 14th June 2023 Sample size was calculated by sample size calculator(statistics kingdom) employing a normal distribution, with margin of error 0.04, confidence level of 0.80(z-score of 1.28) and standard deviation of 0.24, the sample size was calculated to be 60 total subjects. Random sampling was used and bunched in two groups using the lottery method; patients had co-induction and inj. dexamethasone 4mg, propofol 1.5mg/kg, inj. cisatracurium 0.15mg/kg as muscle relaxant for intubation in both groups. In group A and B, patients also received 0.5mg/kg propofol thirty seconds and 1.5 mg/kg lidocaine three minutes before laryngoscopy respectively. Cardiovascular parameters, i.e. (pulse, blood pressure) were monitored. Paired-sample T test employed with a confidence interval (of 95%)analysing heart rate and mean blood pressure values with determination of significant P-value greater than 0.05. SPSS v 26 was used.

Results: In group-A, 90% of cases more stable heart rate was noted as compared to group-B with a value of (63.3%). No incidence of bradycardia was noted in group-A, whereas in group-B it was 6.7%. Concerning mean blood pressure, raised values were noted in 23.3% cases and 30% cases in Group A and B respectively and stable systolic blood pressure values were seen in 80% and 66.7% cases in Group A and B respectively.

Conclusions: The propofol repeat dose before intubation showed stable hemodynamic (pulse and mean blood pressure) values as compared to lidocaine following laryngoscopy in general anaesthesia.

Key words: Anesthesia induction, Cardiovascular response, Hemodynamics, Propofol

How to cite this Article:
Maqbool MS, Hamza HA, Zubair F, Irshad K, Saleem A. Comparison of Hemodynamic Response to Laryngoscopy/ Intubation: Intravenous Lidocaine vs Repeat Dose Propofol. J Bahria Uni Med Dental Coll. 2025;15(2):73-79 DOI: https://doi.org/10.51985/JBUMDC2024457

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Received: 18-10-24
Accepted: 27-03-25
1st Revision: 27-10-24
2nd Revision: 12-02-25
3rd Revision: 14-03-25

INTRODUCTION:

Despite statistics portraying that various techniques such as: intra-venous local anaesthesia (bier block), regional blocks(e.g. brachial, sciatic block etc.) and central neuraxial blocks(intra-thecal, epidural etc.) can be employed for anesthesia and analgesia in surgical procedures as sole anesthetic technique, but general anesthesia with tracheal intubation is normally preferred for major surgical(thoracic, head and neck, abdominal, cardio-pulmonary and neurosurgical) procedures and not possible without it.[1] Primary focus in general anesthesia at induction is to employ balanced anesthesia technique peri-operatively to maintain homeostasis primarily cardiovascular (pulse, systolic, diastolic and mean blood pressure) and respiratory (assisted manual ventilation to prevent hypoxia and hypercarbia) for patient safety followed by placement of tracheal tube and ensuing controlled ventilation.[2] Induction of anaesthesia carries risk factors involving mainly patient's medical status, anesthetic medications used, hypersensitivity reactions and surgical technique.[3] Medication used for induction may cause peri-

operative hypotension.[1] A 20-30% or greater decline in systolic blood pressure as regard to baseline value(intra-operative hypotension) or mean blood pressure value less than 80mmHg may have unfavorably outcome and affects patients with ischemic heart disease, uncontrolled/labile blood pressure, and arrythmia's due to lowering of cardiac perfusion pressure as quantified in various studies.[4] Various other researches portrayed relation of severe hypotension at induction phase of anesthesia to delayed emergence from anaesthesia or even risk of stroke.[5]

Laryngoscopy and particular tracheal tube placement may cause hypertension and tachycardia due to stretching of pharyngeal /laryngeal structures (involving X and X1 cranial nerves).[1,2,6] Though these responses are usually well in young healthy patients but in patients with co-morbid diseases may cause myocardial ischemia, arrythmia's, left ventricular failure, sub-arachnoid hemorrhage or stroke.

These hemodynamic changes (heart rate, blood pressure) are evident at one minute interval and can last for a few minutes of laryngoscopy.[7] Thus, general anesthesia induces endocrine and immunologic reflex response (mainly cortisol, complement and interleukin) as well as metabolic acid base balance disturbances.[8]

Various induction medications have been advocated in studies, e.g. barbiturates, midazolam, nalbuphine, dexmedetomidine, etomidate, propofol.[1,2,9]

To blunt intubation pressor hemodynamic response, medications/techniques stated in literature include nitroglycerine, lidocaine, inhalational volatile anesthetics, fentanyl, topical anesthetic spray, calcium channel blocker, laryngeal mask airway, video-laryngoscope usage and top-up dose of propofol.[1,2,9]

Also employing a balanced anaesthesia medication approach/technique that will result in a stable hemodynamic (pulse and blood pressure) state per-operatively, particularly following endotracheal intubation.[1,2,9]

Lidocaine is a membrane anaesthetic(amide type), its mode of action(membrane stabilizing effect) is mediated by blockade of sodium channels. It is also used as an adjuvant to tracheal intubation to obtund cerebro-hemodynamic response to laryngoscopy.[2,10] It is usually given in dose of 1.5mg/kg three minutes before intubation.[10] Propofol is widely used nowadays for induction of anaesthesia in adults, with two popular techniques:(a)induction dose of propofol(2-2.5mg/kg) followed by smaller bolus dose and (b)target-controlled infusion technique. Deepening anaesthesia with a bolus propofol dose might be helpful when using a smaller initial dose of propofol(1-2mg/kg), thus it will minimize cardiovascular and respiratory(apnea) depressant effects.[11] As inferred from the above points stabilizing hemodynamics at induction phase of anaesthesia, would circumvent patient morbidity and mortality.

The rationale of this study was to foresee hemodynamic response to induction and laryngoscopy of repeat dose propofol in comparison to lidocaine. As fewer studies are documented in the literature studying hemodynamic effects of incremental bolus dose of propofol at laryngoscopy in general anaesthesia.

Primary outcome variables were: pulse rate, systolic, diastolic and mean blood pressure (with aim to keep them within 15% of baseline values) and noting raised blood pressure, pre-mature ventricular contractions (PVC), bradycardia and tachycardia. Whereas secondary variables covering qualityof anesthesia (intubating conditions) were monitored by noting involuntarypatient movement at laryngoscopy, stylet use, cricoid pressure, bronchospasm, coughing and backward upward rightward pressure (BURP) manoeuvre to aid glottic view and medication needed to control hemodynamic i.e. heart rate changes and blood pressure fluctuations.[9] This study will help to implore technique in hemodynamic pressor control of blood pressure at induction.

METHODOLOGY :

Study protocol was authorized by the Research Advisory Committee& Institutional Review Board (Letter No.RAC&IRB-14/6/2023); Akhtar Saeed Medical College, Main Murree Expressway Bahria Golf City, Rawalpindi in meeting held on 14th of June,2023. Sample size was calculated by sample size calculator (statistics kingdom) employing a normal distribution, with margin of error 0.04, confidence level of 0.80(z-score of 1.28) and standard deviation of 0.24, the sample size was calculated to be 60 total subjects participating in the research divided randomly into two groups by using computer generated allocations from elective surgical schedule (n=30) in each group. This single blind (randomized controlled) interventional study was plotted with random sampling methodology divided into 2 groups by lottery method and convened at Farooq Hospital Islamabad (Rwp), by the Anesthesia Department.

The duration of the conducted study was about five months, and the period was from 21st June 2024 to 4th October 2024.The inclusion criteria of the study being (aged 21-70years) placed on elective general surgical/gynecological/ head and neck procedures like (cholecystectomy, total abdominal hysterectomy, septoplasty etc.) to be done under general anaesthesia (with tracheal intubation).[11] The patients belonging to American Society of Anesthesiologist (ASA) class-1 and 2 of both genders were eligible for the study and fulfilling above stated eligibility criteria were included in study.[12]

The patients were not aware of group allocation. Patients had standard pre anaesthesia assessment and as regard to informed consent patients were explained pertinent information as regard to technique of anesthesia, risks and benefit of anesthesia in simple phrases so that patients were able to make a decision of voluntary participation in research,

which was also taken in written format as well.[1]The exclusion criteria of study were patients with history of difficult airway, acute abdomen, pregnant woman, hypersensitivity to soybean oil, egg lecithin, ischemic and stenotic valvular heart disease patients.[11]

In both groups in the study patients fasted was as per ASA guidelines whereas in operation theatre after intravenous isotonic fluid attachment and cardiac monitors attachment (pulse oximetry, blood pressure, electrocardiograph) patients in both groups had co-induction with (intravenous inj. midazolam 0.05 mg/kg and inj. Nalbuphine 0.1mg/kg)along with inj. Dexamethasone 4mg.[2] Secondly, anesthesia induction was with propofol in a dose of 1.5mg/kg and inj. cisatracurium 0.15mg /kg as muscle relaxant for intubation in both groups. Only difference in both groups at induction being that in group-A patients received 0.5mg/kg repeat dose propofol thirty seconds (n=30) and in group-B patients received 1.5 mg/kg lidocaine (n = 30) three minutes before laryngoscopy.

Patient's cardiovascular hemodynamic parameters, i.e. (systolic, diastolic and mean blood pressure), heart rate and respiratory pulse oximeter were monitored at pre-induction (baseline value) and after endotracheal intubation at[1,3,7] and 10-minute intervals. Patients were manually ventilated for 2.5 minutes before laryngoscopy and an appropriately sized cuffed-tracheal tube placed and controlled ventilation was commenced after confirmation of tracheal tube placement, using visual placement of endotracheal tube, capnograph tracing, bilateral chest auscultation, according to ASA guidelines and standard general anesthesia techniques employed maintaining hemodynamic stability in both groups.[12] All patient data was recorded on the anesthesia proforma and patient confidentiality was fully ensured. Hypotension (defined as a mean arterial pressure <60 mmHg or >30% reduction from baseline) was treated by fluid administration first, if not corrected then by intravenous 50 mcg bolus of phenylephrine; bradycardia (heart rate less than ? 40) was treated by inj. Atropine 0.5mg intravenously. The primary outcomes noted were systolic, diastolic blood pressure changes: particularly rise in mean arterial blood pressure (of 30mmHg) and heart rate variations and noting rise in heart rate (up to 25 beats per minute) as intubation pressor response, bradycardia, hypotension, and secondary outcome, intubation condition as well as medications to control cardiovascular hemodynamic changes to normal baseline values. Researcher in the study only knew about the medication administered to the subject, and a specialist anesthetist who was not participating in the trial outcome performed lottery-generated randomization of groups and gave study medications in a sealed envelope and unbiased handling of data was ensured. Paired-samples T test was used with confidence interval (of 95%) to analyze variables (heart rate and mean blood pressure) in both groups and to seek significant P-value greater than 0.05.[13]The study hypothesis was the assessment of superiority of repeat dose propofol in comparison with lidocaine in maintaining stable hemodynamic variables following intubation. SPSS v 26 was used for statistical analysis.

RESULTS:

The study parameters, demographic along with intubating conditions of both groups are depicted in Table 1.

There were no cases of any stylet/ bougie use, i.e. any difficult airway case in both groups under study. The hemodynamic data(mean / standard deviation) at the time line in a study is represented in Table 2. The variations of hemodynamic parameters(heart rate, systolic and mean blood pressure) noted while conducting the study are depicted in Table 3. The data provides evidence for a clinically important systolic and stable heart rate value as stated in Table 3 in favour of group-A, supported by Paired-samples T statistical analysis test as shown in Table 4.

DISCUSSION:

Study by Ghomeishi A and colleagues compared stress hormone effects on hemodynamic variables in patients undergoing laparoscopic gallstones surgery under general anaesthesia (propofol 75µg/Kg/min vs dexmedetomidine 0.5 µg/Kg/min infusion) started peri-operatively and continued for ten minutes into post-surgical recovery area. They inferred that propofol employed had good effect on inflammatory surgical stress level (epinephrine being the neurotransmitter), but no difference can be inferred in hemodynamic variables i.e. heart rate, blood pressure readings from graphical data in first five minutes after intubation in both groups; though continued infusion showed that dexmedetomidine group had more stable long term effect on heart rate and mean arterial blood pressure readings in comparison to propofol group ($P < 0.001$) on repeated ANOVA test analysis.[14]In our study group-A propofol use resulted in stable heart rate and systolic blood pressure parameters noted in 27 subjects(90.0%) and 24 subjects(80%) respectively.

Seangrung R conducted study to foresee blood pressure and heart rate change still ten minutes post-intubation, using 0.5mg/kg propofol given 30 seconds before intubation along with lidocaine 1.5mg//kg at induction showed that occurrence of hypotension was 15.09% as compared to 52.83% and also less episodes of bradycardia (0%vs 18.87%, P=0.001) than the dexmedetomidine(1 ìg/ kg given at induction) group.[15] Same additional dose of 0.5mg/kg propofol(group-A) was used in our current study with no incidence of bradycardia observed, whereas in lidocaine group-B in 2 cases (6.7%) bradycardia occurred.

Prospective, randomized, double-blind research by Kwon MA and colleagues compared 3 induction doses of propofol, i.e. 1.5mg/Kg in group A and B and 2mg/Kg in group C. Whereas 0.5mg/Kg of bolus dose of propofol was given 45

Table-1: demographic / intubating parameters(n=30)

	Parameters	Group-A	Group-B
Age(years)	mean/standard deviation	45.70/14.34	46.86/12.71
	Minimum/maximum	21/69	23/70
ASA-classes (frequency/percentage)	Class-1	23/76.7	7/23.3
	Class-2	14/46.7	16/53.3
Gender (frequency/percentage)	Males	8/26.7	5/16.7
	Females	22/73.3	25/83.3
Intubating conditions (frequency/percentage)	Involuntary patient movement noted	Nil	1/3.3
	No movement noted	30/100	29/96.7
	Bronchospasm noted	Nil	1/3.3
	BURP maneuver applied for glottic view	Nil	5/16.7

Table 2: Statistical hemodynamic data (mean / standard deviation) at the time line in both groups(n = 30)

	Group	Time Interval (minutes)	Mean / Standard deviation
Heart rate	A	Baseline	89.67/18.05
		1	85.90 / 14.96
		3	81.17 / 12.10
		7	78.80 / 11.33
		10	79.27/ 10.48
	B	Baseline	91.10/18.37
		1	94.40 / 18.13
		3	93.93 / 19.61
		7	89.07 / 17.39
		10	84.50 / 12.74
Mean blood pressure	A	Baseline	103.20/20.57
		1	94.43 / 16.71
		3	85.13 / 16.46
		7	82.47 / 13.48
		10	81.13 / 15.44
	B	Baseline	112.30/23.98
		1	99.90 / 24.46
		3	99.53 / 26.03
		7	94.23 / 19.90
		10	89.50 / 18.32
Systolic blood pressure	A	Baseline	143.53/20.97
		1	125.53 / 17.85
		3	118.20 / 20.94
		7	111.97 / 16.48
		10	113.27 / 16.88
	B	Baseline	150.20/25.68
		1	136.07 / 30.56
		3	134.13 / 34.05
		7	124.20 / 25.06
		10	119.70 / 20.76

Table-3: Variations in hemodynamic data.(n=30)

			Group -A	Group -B
			(Frequency / Percent)	
Hemodynamic parameters	Blood pressure (Systolic)	Normal	24 / 80	20 / 66.7
		Low	2 / 6.7	3 / 10.0
		High	4 / 13.3	7 / 23.3
	Bradycardia	No	Nil	28 / 93.3
		Yes		2 / 6.7
	Tachycardia	No	27 / 90.0	19 / 63.3
		Yes	3 / 10.0	11 / 36.7
	Mean blood pressure	Normal	22 / 73.3	21 / 70.0
		Raised	7 / 23.3	9 / 30.0
		Low	1 / 3.3	Nil

Table - 4: Statistical Paired-samples T test of both groups. (n=30)

		Paired Differences 95% Confidence Interval of the Difference				
		Lower	Upper	t	df	Sig. (2-tailed)
		Group-A / Group-B				
Pair 1	Pre-Induction heart rate - Heart Rate at 1 minute	-1.316 /-9.312	8.849/2.712	1.516 / -1.123	29	.140 / .271
Pair 2	Heart Rate at 3 minutes- Heart Rate at 10 minutes	-1.783/ 2.861	5.583/ 16.005	1.055 / 2.936	29	.300 / .006
Pair 3	Pre-Induction mean BP - Mean BP at 1 minute	.744 / 4.726	16.790 / 20.074	2.235 / 3.305	29	.033 / .003
Pair 4	Mean BP at 3-minutes - Mean BP at 10 minutes	-2.910 / 1.515	10.910 / 18.551	1.184 / 2.409	29	.246 / .023

seconds before laryngoscopy in group B. Intubating conditions and hemodynamic stability (blood pressure, heart rate) were noted. They noted satisfactory intubating conditions of 91.1% in group B in comparison to 61.8% and 58.8% in group A and C respectively. They concluded that a repeat dose propofol of 0.5mg/Kg before laryngoscopy improves intubating situations with less concern about the occurrence of hypotension.[16]Similar protocol of repeat dose propofol was employed in our study. Though no premature ventricular contractions were observed after intubation and no hypoxia was observed in both groups of our study at the time of assisted manual ventilation before intubation. Vasopressors were used in group A and B in 1 case (3.3%) and 3 cases (10%) respectively. In group-B, in 1 case (3.3%) atropine was used to treat bradycardia, whereas in group-A, no bradycardia was reported.

In study by Safavi M on hemodynamic variability and intubating conditions employing three infusions of propofol i.e. 0.5mg,1mg and 1.5mg/kg on laryngoscopy in addition to initial induction dose of 1mg in 2nd and 3rd group respectively with 2mg/kg induction single dose in 4th group only, with no additional propofol infusion dose, intubation conditions in group Ist,2nd,3rd and 4th, were 91.4%, 94.2%, 97.1% and 68.5% respectively; they noted no statistical differences in heart rate mean value between all groups in baseline and after laryngoscopy readings. The mean arterial pressure was profoundly low in group D in comparison to group A(P=0.015). Whereas in other groups, mean arterial blood pressure was not statistically different.[17]In our study, in group-A, more stable mean heart rate at one minute after laryngoscopy was 94.43±16.71 in comparison to a baseline value of 89.67±18.05, while the same values in group-B were 94.40 ± 18.13 and 91.10 ±18.37 respectively.

In study by K Zou Y and colleagues studying hemodynamic response to intubation employing balanced anesthesia (midazolam/sufentanil as adjunct) technique; effect of lidocaine doses (1 and 1.5 mg/kg with placebo) along with propofol induction and cisatracurium as muscle relaxant, noted lidocaine attenuated increase in blood pressure, but effective in controlling heart rate upto five minutes of intubation.[22]We in our study employed similar balanced anesthesia technique.

Ivascu R, in study on reviewing surgical stress response to surgery pointed that propofol impacts the stress response by inhibiting mainly sympathetic nervous system; the agent used in our study protocol.[4]A study comparing conventional dose (2-2.5mg/kg) of propofol versus titrated propofol administration in ASA I and II cases in general anaesthesia, the titrated propofol group had low post-laryngoscopy hypotension incidence of (9 vs. 19 cases with p value of 0.04). They inferred that in comparison to the conventional induction dose of propofol, the titrated propofol dose reduces

hypotension incidence.[4] A similar dosage schedule was used in our study. In another comparative study done by Balasubramanyam V and colleagues on hemodynamic adverse changes at endotracheal intubation, it was inferred that both esmolol and propofol are equally effective in blunting intubation hemodynamic reflex response.[19] Finding was similar to our study. A retrospective cohort study was done by Kawasaki to ascertain propofol induction dose prediction formula (employing age, female gender, body weight and fentanyl dose)and found it to help decrease hemodynamic fluctuations at anaesthesia induction.[20]

Sekiguchi R in their studyfound no statistical difference in hemodynamic parameter between remimazolam and propofol use i.e. mean arterial blood pressure percentage value of 35% and 55% (?than 65mm/Hg); but non-significant p value of 0.341)respectively as induction agents; stating that it is not only the choice of induction agent rather also dose and usage of adjunct anaesthetic medication as important factor in determining hemodynamic stable state at induction.[21]Similar titrated dose of propofol(lower induction followed by repeat dose) schedule was used by us with effective results. A study by Vale AGG and colleagues on arterial hypotension incidence at induction of general anesthesia observed that propofol is routinely given by bolus dose or manually or target controlled infusion system, they in their study stated that patients who had bolus induction dose of propofol showed lower blood pressure values(mean) in comparison to target controlled infusion technique in their study, though interaction in both study groups remained inconclusive. But in our study a lower induction dose of propofol with a bolus before laryngoscopy had stable pulse and mean blood pressure values.[22]Patients who received propofol bolus injection exhibited a lower mean arterial pressure, a greater variation in the level of consciousness, and a higher suppression rate compared to those who received it as a target-controlled infusion. However, the interaction effect between groups and time remains inconclusive.

CONCLUSION:

The propofol repeat dose before intubation showed stable hemodynamic (pulse and mean blood pressure) values as compared to lidocaine following laryngoscopy in general anaesthesia.

Authors Contribution:
Muhammad Salman Maqbool: Concept & Design of Study, Drafting, Revisiting Critically, Data collection & Analysis, Final Approval of Version
Hasnain Ameer Hamza: Drafting, Revisiting Critically, Data collection & analysis
Fahad Zubair: Drafting, Revisiting Critically, Data collection & analysis
Kainat Irshad: Drafting, Revisiting Critically, Data collection & analysis
Affifa Saleem: Drafting, Revisiting Critically, Data collection & analysis

REFERENCES:

1) Lewar EI, Maharyawan IWA, Yusniawati YNP, Takandjandji C. The Effect of Intravenous Induction of Anesthesia on the Hemodynamic Changes among Patients in Central Surgical Unit of Level-II Udayana Denpasar Hospital. BabaliNurs. Res. 2022 Nov.30 [cited2024Sep.10];3(3):185-93. DOI: https://doi.org/10.37363/bnr.2022.33111

2) Joshi A, Raghu S, Singh H, Garg M. To Study the Hemodynamic Variation to Laryngoscopy and Endotracheal Intubation While Comparing the Effectiveness of Nebulised Vs Intra-Venous Form of 2% Lidocaine to Attenuate the Sympathetic Response to Laryngoscopy in Indian Population. Int J Clin Anesthesiol 2023;11(2):1126 DOI: http://dx.doi.org/10.33545/26643766.2023.v6.i3a.408

3) Ivascu R, Torsin L.I, Hostiuc L, Nitipir C, Corneci D,Dutu M. The Surgical Stress Response and Anesthesia: A Narrative Review.J. Clin. Med. 2024;13(10):3017 DOI: https://doi.org/10.3390/jcm13103017

4) Chen L, Lu K, Luo T, Liang H, Gui Y, Jin S. Observer's Assessment of Alertness/Sedation-based titration reduces propofol consumption and incidence of hypotension during general anesthesia induction: A randomized controlled trial. Sci Prog. 2021 Oct;104(4):368504211052354 DOI: 10.1177/00368504211052354.

5) Katori N, Yamakawa K, Kida K, Kimura Y, Fujioka S, Tsubokawa T. The incidence of hypotension during general anesthesia: a single-center study at a university hospital. JA Clin Rep. 2023 ;9(1):23 JA Clin Rep 2023May 13; 9:23 DOI: 10.1186/s40981-023-00617-9

6) Lakhe G, Pradhan S, Dhakal S. Hemodynamic Response to Laryngoscopy and Intubation Using McCoy Laryngoscope: A Descriptive Cross-sectional Study. J Nepal Med Assoc. 2021 Jul1;59(238):554-557 DOI: 10.31729/jnma.6752

7) Elsabeeny WY, Shehab NN. The role of high dose fentanyl, magnesium and lidocaine for effective and consistent attenuation of hemodynamic responses during laryngoscopy and intubation. Anaesth. pain intensive care 2022;26(3): 352-359.DOI: https://doi.org/10.35975/apic.v26i3.1910

8) Singh M, Basu M, Ghosh A, Pal R., Mitra M. Comparison of hemodynamic response of intravenous lidocaine and esmolol during laryngoscopic intubation under general anesthesia for major abdominal surgery. Asian J. Med. Sci 2024;15(4): 47–52 DOI:https://doi.org/10.3126/ajms.v15i4.60404

9) Shahid A, Maqbool MS, Shabbir S, Hameed FM, Shabana N, Tayyab F. Prevention of Pressor response to Laryngoscopy: A Comparison of Lignocaine with Dexmedetomidine. J Bahria Uni Med Dental Coll.2023;13(3):201-5 DOI: https://doi.org/10.51985/JBUMDC2023177

10) Zou Y, Kong G, Wei L, Ling Y, Tang Y, Zhang L, Huang Q. The effect of intravenous lidocaine on hemodynamic response to endotracheal intubation during sufentanil-based induction of anaesthesia. Anaesthesiol Intensive Ther. 2020;52(4):287-291 DOI: 10.5114/ait.2020.99918

11) Vullo PA, Real Navacerrada MÍI, Navarro Suay R. Hemodynamic impact of increasing time between fentanyl and propofol administration during anesthesia induction: a randomised, clinical trial. Braz J Anesthesiol. 2024 Jan-Feb;74(1):744230 DOI: 10.1016/j.bjane.2021.07.009

12) Mayhew D, Mendonca V, Murthy BVS. A review of ASA physical status - historical perspectives and modern developments. Anaesthesia. 2019 Mar;74(3):373-379

13) Tyagi A, Garg D, Mohan A, Salhotra R, Vashisth I, Agrawal A, Deshpande S, Deep S, Das S, Malhotra RK, Pradhan R, Panda A. Overview of statistical methods usage in Indian anaesthesia publications. Indian J Anaesth. 2022 Nov;66(11):783-788 DOI: 10.4103/ija.ija_667_22

14) Ghomeishi A, Mohtadi AR, Behaeen K, Nesioonpour S, Bakhtiari N, Khalvati, Fahlyani F. Comparison of the Effect of Propofol and Dexmedetomidine on Hemodynamic Parameters and Stress Response Hormones During Laparoscopic Cholecystectomy Surgery. Anesth Pain Med. 2021 Dec 12;11(5): e119446Anesth Pain Med 2021 Dec 12;11(5): e119446 DOI: 10.5812/aapm.119446

15) Seangrung R, Pasutharnchat K, Injampa S, Kumdang S, Komonhirun R. Comparison of the Hemodynamic response of dexmedetomidine versus additional intravenous lidocaine with propofol during tracheal intubation: a randomized controlled study. BMC Anesthesiol. 2021 Oct 30;21(1):265 DOI: 10.1186/s12871-021-01484-6

16) Kwon MA, Kim SK, Jeon DG, Song JK, Kim WI. The effect of additional propofol on intubation conditions. J Clin Anesth. 2010 Dec;22(8):603-7 DOI: 10.1016/j.jclinane.2010.05.004

17) Safavi M, Honarmand A, Banisadr G. Comparing the effects of three different additional doses of propofol infusion on intubation condition and hemodynamic changes during general anesthesia under elective surgery: A randomized, placebo-controlled, double blind clinical trial. Adv Biomed Res.2014;28; 3:122 DOI: 10.4103/2277-9175.133195

18) K Zou Y, Kong G, Wei L, Ling Y, Tang Y, Zhang L, Huang Q. The effect of intravenous lidocaine on hemodynamic response to endotracheal intubation during sufentanil-based induction of anaesthesia. Anaesthesiol Intensive Ther. 2020;52(4):287-291 DOI: 10.5114/ait.2020.99918

19) BalasubramanyamV, Sowmya G, Sai Suraj KN, Jamuna T. A comparative study of attenuation of stress response during intubation with esmolol and propofol. J. Evid. Based Med. Health. 2018; 5(2), 150-154 DOI:10.18410/jebmh/2018/33

20) Kawasaki S, Kiyohara C, Tokunaga S, Hoka S. Prediction of hemodynamic fluctuations after induction of general anesthesia using propofol in non-cardiac surgery: a retrospective cohort study. BMC Anesthesiol. 2018 Nov 10;18(1):167 DOI: 10.1186/s12871-018-0633-2

21) Sekiguchi R, Kinoshita M, Kawanishi R, Kakuta N, Sakai Y, Tanaka K. Comparison of hemodynamics during induction of general anesthesia with remimazolam and target-controlled propofol in middle-aged and elderly patients: a single-center, randomized, controlled trial. BMC Anesthesiol.2023 Jan 10;23(1): 14 DOI: 10.1186/s12871-023-01974-9

22) Vale AGG, Govêia CS, Guimarães GMN, Terra LR, Ladeira LCA, Essado GA. Comparison of arterial hypotension incidence during general anesthesia induction - target-controlled infusion vs. bolus injection of propofol: a randomized clinical trial. Braz J Anesthesiol. 2024;74(4):844503 DOI: 10.1016/j.bjane.2024.844503