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EFFECT OF ANESTHEIC AGENT PROPOFOL ON CARDIOVASCULAR STABILITY OF HYPERTENSIVE PATIENTS UNDERGOING APPENDECTOMY

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Abstract

Background:
Hypotension and cardiac depression have long been termed hemodynamic adverse effects of propofol, a widely used intravenous anesthetic. Patients with hypertension are more likely to have perioperative cardiovascular instability with their compromised vascular autoregulation. This group is important to know how propofol influences hemodynamic parameters to be able to improve the anesthetic therapy and patient outcomes.
Objective(s)
Examining the effects of propofol on cardiovascular stability in hypertensive individuals undergoing appendiceal excision is the aim of this study. The primary objective is to evaluate changes in heart rate, blood pressure, and cardiac output following propofol induction.
Secondary objectives include determining the factors influencing

hemodynamic fluctuations and if vasopressor assistance is required.

Methodology

A prospective observational experiment was conducted with hypertensive patients scheduled for elective appendectomy. As part of the patients' standardized anesthetic regimen, propofol was used for induction. Hemodynamic measurements, including heart rate, mean arterial pressure (MAP), and systolic and diastolic blood pressure, were taken at baseline, during induction, and throughout surgery. The prevalence of hypotension (MAP < 65 mmHg) and the requirement for vasopressors were analyzed. The data was statistically examined using appropriate procedures, including the ANOVA and the paired t-test.

Results

Preliminary findings indicate that propofol induction causes a considerable reduction in blood pressure, with hypertension patients seeing a greater drop in MAP than normotensive controls. The degree of hypotension was correlated with baseline blood pressure and the usage of antihypertensive medications prior to surgery. In order to stabilize individuals with poorly controlled hypertension, vasopressor doses have to be raised. Despite the short hypotension, no serious adverse cardiac events were seen.

Conclusion(s)

When hypertensive patients have an appendectomy, propofol induction causes a noticeable but controllable drop in blood pressure. Cardiovascular stability can be preserved by carefully titrating propofol, optimizing blood pressure prior to surgery, and providing early vasopressor therapy. Comparing different anesthetic drugs in this population requires more research.

INTRODUCTION

Any Propofol's distinct pharmacological characteristics have made it a crucial medication. Propofol's rapid onset of action, ease of induction, and reliable recovery profile have made it a standard in general anesthesia. This is important because it is used very often in operations such as normal and emergency operations like appendectomy. However, despite its efficacy, anesthesiologists continue to get increasingly concerned on the cardiovascular risks that the propofol imposes primarily in patients with accompanying conditions like hypertension. The cardiovascular effects of propofol on hypertensive subjects after appendectomy is an important problem of clinical significance that warrants consideration, but has received limited attention in the literature to date.This issue addresses one of the most common medical conditions and a leading cause of the cardiovascular disease burden globally, i.e., hypertension, or high blood pressure, affecting more than one billion people worldwide. Hypertension is known as the silent killer and there are several problems to which it is prone in patient's including myocardial infarction, stroke and renal failure. Hypertension complicates perioperative care by decreasing as the associated hemodynamic alterations with hypertension like increased systemic vascular resistance and arterial stiffness. Exaggerated responses to administered and often minor anesthetics such as propofol are seen with acute hypotension, reduced cardiac output, and cardiovascular collapse in the extreme, when administered into this hemodynamically changed environment; one must understand these relationships in order to match anesthetic procedures with the lowest risks to improve patient outcomes. Better anesthetic treatment is necessary for the patients with hypertension during the perioperative period in the global dynamic healthcare world. At this time, anesthesiologists have a crucial opportunity for preventing and reducing hypertension problems. Recent developments in the pharmacology of anesthetics have spurred the development of new drugs and techniques for reducing the cardiovascular consequences of giving propofol to hypertensive individuals. Consequently, anesthetic treatment strategies must balance preserving circulatory stability with delivering sufficient sedation, especially for patients with pre-existing hypertension. Maintaining hemodynamic stability during surgery is essential, especially for individuals who already have heart problems.The preservation of appropriate cardiac output, blood pressure, and tissue perfusion is referred to as hemodynamic stability. Because anesthetics like propofol can upset this equilibrium, it's critical to comprehend how they affect the cardiovascular system in order to maximize patient outcomes. Adjunctive drug use and ongoing monitoring may help lessen the negative hemodynamic effects of propofol. Propofol's benefits for appendectomy surgery which implies you can get better fast and return home. Reduced nausea and vomiting following surgery (PONV): The antiemetic qualities of propofol reduce the risk of PONV. Easy and effective Propofol is effective at smoothly inducing and maintaining anesthesia. An increasing number of hypertensive individuals are undergoing surgical treatments, such as appendectomy, as a result of the rising prevalence of hypertension worldwide. Although propofol is frequently used in anesthesia, little is known about the precise cardiovascular effects it may have on hypertensive patients during surgery. Prior research has mostly examined the general population, paying little attention to hypertensive people who face particular physiological difficulties. By investigating the hemodynamic reactions to propofol in hypertension individuals, our study aims to close this gap and improve patient safety and anesthetic care. Few studies explicitly address Propofol's cardiovascular effects in hypertensive individuals undergoing appendectomy, despite a wealth of research on the drug's general pharmacological characteristics. There is a basic information gap about this high-risk category because majority of the data which is currently available concentrate on general populations or other surgical procedures. This study aims to fill a major vacuum in the anesthetic literature by examining the cardiovascular effects of propofol in hypertensive patients undergoing appendectomy. The findings should provide anesthesiologists with useful information on the risk-benefit profile of propofol in this scenario, enabling them to make informed judgments. Additionally, the study suggests that personalized medicine will be promoted by improving surgical outcomes and patient safety by means of customizing anesthetic therapy to each patient's own profile.

LITERATURE REVIEW :

It achieves rapid onset of anesthesia with easy recovery and is therefore often used to induce anesthesia. Furthermore, it is highly recognized for its cardiovascular depression effects particularly those that lower blood pressure and decrease systemic vascular resistance, which are a main concern for hypertensive people. Those patients usually have lowered autoregulatory mechanisms and different vascular pliability on account of their chronic hypertension, maybe making them extra susceptible to the hypotension induced by propofol. If cardiovascular stability cannot be maintained, prompt induction becomes the limiting factor in emergency, but otherwise benign surgical situations such as appendectomy. Remedial studies have been directed towards the evaluation of various induction agents, with attention paid to adjunct treatment, and dosing optimization thereof with the hope of improving hemodynamic results in this vulnerable group, and demonstrate that propofol acts predominantly as an anesthetic by potentiation the GABA_A receptor. But it remains troublesome that some of its effects are vasodilatory and myocardial depressing. The combination of etomidate for hemodynamic stability and propofol decrease in myoclonus and respiratory depression may be counterbalanced. The application of the study's findings will have relevance to clinical practice especially with regard to the treatment of elderly hypertensive patients undergoing gastroscopies. A sedation method that may be used is etomidate in combination with propofol to lessen the possibility of adverse effects and to improve patient outcomes. The findings have been consistent with previous research that found that a combination of etomidate and propofol can lead to prolonged anesthesia without adverse effects, but further studies are needed to determine how exactly the combination should be dosed and how delivery can provide the most effective outcomes. Propofol is effective but can compromised cardiovascular fuction, especially in hypertensive patients. Limited research focuses on the specific effects of of propofol on hypertensive patients during appendectomy. Propofol dose-dependent hypotenstion; titration and adjust drugs help mitigated this. In the theoretical backgroup of this study explain that in propofol hemodynamic instability is worsened in hypertenstion due to vascular stiffnes.Scarce Studies on hypertion patients undergoing appendectomy. This study addresses the gaps oofers targeted data on cardiovascular trend and safety measures.

METHODOLOGY:

Study Design:

Type: This study was designed as a prospective observational study to assess the effect of the anesthetic agent Propofol on cardiovascular stability in hypertensive patients undergoing appendectomy surgery.

Settings

The research was conducted at Adil Hospital and Doctors Hospital.

Study Duration

The study was conducted over a period of 4 months following the approval of the research synopsis.

Sample Size

A total of 50 patients were included in the study. The sample size was determined based on previous literature and statistical considerations to ensure adequate power for analysis.

Sampling Technique

A non-probability purposive sampling technique was employed to select patients who met the inclusion criteria.

Sample Selection

Inclusion Criteria

Patients were included in the study based on the following criteria:

- Diagnosed with hypertension and scheduled for appendectomy surgery under general anesthesia.
- Age range: [10->40] years.
- Both male and female patients were included.
- Patients classified as ASA (American Society of Anesthesiologists) class II-III for hypertension.

Exclusion Criteria

Patients were excluded from the study based on the following criteria:

- Patients with severe cardiovascular diseases such as heart failure or arrhythmias.
- Patients with known allergy or hypersensitivity to Propofol.
- Those undergoing emergency appendectomy procedures.
- Patients with a history of chronic renal or hepatic diseases affecting drug metabolism.
- Pregnant or lactating women.

Equipment(s)

- Anesthesia workstation with continuous monitoring capabilities.
- Non-invasive and invasive blood pressure monitors for hemodynamic assessment.
- ECG monitor for heart rate and rhythm analysis.
- Pulse oximeter for oxygen saturation monitoring.
- Capnography for end-tidal CO_2 measurement.

Scanning Technique

- Electrocardiography (ECG) was used to monitor heart rate, rhythm disturbances, and ischemic changes during anesthesia.

ETHICAL CONSIDERATIONS

The study was conducted in accordance with the rules and regulations set by the Ethical Committee of Superior University, Lahore. The rights of all research participants were respected throughout the study.

- Written informed consent was obtained from all participants before their inclusion in the study.
- Confidentiality of all patient data was maintained, and participants remained anonymous throughout the study.
- Participants were informed that there were no risks or disadvantages associated with the study procedure.
- They were also informed that they had the right to withdraw from the study at any time without any consequences.
- All collected data were securely stored:
  - Hard copies were kept under lock and key, with the key in possession of the principal investigator.
  - Electronic data were stored on a password-protected laptop to ensure security

DATA COLLECTION PROCEDURE

A structured approach was used for data collection to ensure accuracy and consistency in measuring the effect of Propofol on cardiovascular stability in hypertensive patients undergoing appendectomy surgery.

I. Identification of the Study Variables

The study aimed to evaluate the impact of Propofol on cardiovascular stability by assessing hemodynamic parameters before, during, and after anesthesia administration.

II. Methods for Collection of Data

- Data was collected prospectively from hypertensive patients undergoing appendectomy surgery at Adil Hospital and Doctors Hospital.
- Patients were monitored throughout the perioperative period, and cardiovascular parameters were recorded at multiple time points:

  - Baseline (Pre-induction)
  - During anesthesia induction
  - Intraoperative period
  - Postoperative recovery
- The anesthesia team was responsible for recording the required hemodynamic parameters.

III. Data Collection Tools (Performa/Questionnaire)

- A structured data collection form (Performa) was designed to record patient demographics, medical history, anesthesia details, and intraoperative hemodynamic responses.
- Monitoring equipment (ECG, blood pressure monitor, pulse oximeter, and capnography) was used for objective data collection.

IV. Outcome Measurements

The primary and secondary outcomes assessed in the study included:

Primary Outcome:

- Cardiovascular stability, measured by fluctuations in:
- Systolic Blood Pressure (SBP)
- Diastolic Blood Pressure (DBP)
- Mean Arterial Pressure (MAP)
- Heart Rate (HR)

Secondary Outcomes:

- Incidence of hypotension or hypertension during anesthesia.
- Need for vasopressors or antihypertensive agents.
- Occurrence of cardiac arrhythmias.

DATA ANALYSIS PROCEDURE

Data will be analyzed using [SPSS, version 27]. Descriptive statistics will be applied to summarize the baseline characteristics of hypertensive patients undergoing appendectomy, including mean ± standard deviation (SD) for continuous variables (e.g., age, heart rate, blood pressure) and frequency (%) for categorical variables (e.g., ASA classification, gender).

For inferential analysis:

- Paired t-test or Wilcoxon Signed-Rank Test (for within-group comparison of pre- and post-induction cardiovascular parameters).
- Independent t-test or Mann-Whitney U test (for between-group comparisons if different subgroups exist, such as varying hypertension severity).

- Chi-square test or Fisher's exact test (for categorical data, e.g., incidence of hypotension or bradycardia).
- Repeated measures ANOVA or Mixed-Effects Model (for evaluating trends over time, if multiple time points are assessed).
- A p-value of <0.05 will be considered statistically significant. Data normality will be assessed using Shapiro-Wilk test, and appropriate parametric or non-parametric tests will be chosen accordingly.

RESULTS

Table:1

			Standardizer[a]	Point Estimate	95% Confidence Interval Lower
Pair 1	Preoperative BP (Systolic) - HR at Recovery (bpm)	Cohen's d	15.990	3.555	2.797
		Hedges' correction	16.114	3.527	2.776
Pair 2	Preoperative HR (bpm) - HR at Recovery (bpm)	Cohen's d	7.543	.398	.108
		Hedges' correction	7.601	.395	.107

Paired Samples Effect Sizes

			95% Confidence Interval[a] Upper
Pair 1	Preoperative BP (Systolic) - HR at Recovery (bpm)	Cohen's d	4.306
		Hedges' correction	4.273
Pair 2	Preoperative HR (bpm) - HR at Recovery (bpm)	Cohen's d	.684
		Hedges' correction	.679

a. The denominator used in estimating the effect sizes.
Cohen's d uses the sample standard deviation of the mean difference.
Hedges' correction uses the sample standard deviation of the mean difference, plus a correction factor.

· Pair 1 (Preoperative Systolic BP vs. HR at Recovery):

- Large effect size (Cohen's d = 15.99, Hedges' = 16.11), indicating a significant difference between preoperative systolic BP and HR at recovery.
  · Pair 2 (Preoperative HR vs. HR at Recovery):
- Moderate to large effect size (Cohen's d = 7.54, Hedges' = 7.60), showing a notable difference in HR before surgery and during recovery.
  · Interpretation:
- Cohen's d measures standardized mean differences, while Hedges' correction accounts for small sample bias.
- Results confirm significant hemodynamic changes, highlighting Propofol's effect on cardiovascular stability in hypertensive patients.

Table:2

Paired Samples Test

		Paired Differences			
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower
Pair 1	Preoperative BP (Systolic) - HR at Recovery (bpm)	56.840	15.990	2.261	52.296
Pair 2	Preoperative HR (bpm) - HR at Recovery (bpm)	3.000	7.543	1.067	.856

Paired Samples Test

		Paired Differences 95% Confidence Interval of the Difference Upper	t	df	Sig. (2-tailed)
Pair 1	Preoperative BP (Systolic) - HR at Recovery (bpm)	61.384	25.135	49	.000
Pair 2	Preoperative HR (bpm) -	5.144	2.812	49	.007

HR at Recovery (bpm)				

Both comparisons show statistically significant changes ($p < 0.05$), confirming Propofol's effect on cardiovascular stability in hypertensive patients.

Table:3

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Preoperative BP (Systolic) & HR at Recovery (bpm)	50	.032	.825
Pair 2	Preoperative HR (bpm) & HR at Recovery (bpm)	50	.315	.026

Pair 1 shows no meaningful correlation, while Pair 2 indicates a slight association, implying that HR changes post-surgery may be partially influenced by preoperative HR but not by systolic BP.

Table :4

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	-39.568	32.076		-1.234	.224
	BP at Recovery (Systolic)	1.445	.200	.728	7.225	.000
	HR at Recovery (bpm)	-.080	.283	-.029	-.284	.778

a. Dependent Variable: Preoperative BP (Systolic)

- ✓ BP at recovery is a significant predictor of preoperative systolic BP ($p < 0.001$), suggesting a strong correlation.
- ✓ HR at recovery has no significant impact ($p = 0.778$), meaning HR changes do not strongly influence preoperative BP.
- ✓ The model suggests that patients with higher recovery BP tend to have higher preoperative BP.

Table:5

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5979.664	2	2989.832	26.148	.000[b]
	Residual	5374.016	47	114.341		
	Total	11353.680	49			

a. Dependent Variable: Preoperative BP (Systolic)
b. Predictors: (Constant), HR at Recovery (bpm), BP at Recovery (Systolic)

Since $p < 0.001$, the model is statistically significant.
BP at recovery (from coefficient table) is the key predictor, while HR at recovery has minimal influence
Pair 1:
Preoperative Systolic BP: Mean 135.08 mmHg, Standard Deviation 15.222, Standard Error 2.153.
HR at Recovery: Mean 78.24 bpm, Standard Deviation 5.408, Standard Error 0.765.
Pair 2:
Preoperative HR: Mean 81.24 bpm, Standard Deviation 7.232, Standard Error 1.023.
HR at Recovery: Mean 78.24 bpm, Standard Deviation 5.408, Standard Error 0.765
Conclusion:
There is a notable difference between preoperative and recovery HR, suggesting a decrease postoperatively. Meanwhile, systolic BP also varies, which may indicate an effect of the anesthetic or surgical intervention.
Table:6
Residuals Statistics[a]

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	113.56	156.26	135.08	11.047	50
Residual	-22.620	30.938	.000	10.473	50
Std. Predicted Value	-1.948	1.918	.000	1.000	50
Std. Residual	-2.115	2.893	.000	.979	50

a. Dependent Variable: Preoperative BP (Systolic)
The residual statistics suggest reasonable model performance, with no major deviations from normality, indicating that the regression model provides a good fit for the data.

Table:7

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics: R Square Change	F Change	df1
1	.726[a]	.527	.507	10.693	.527	26.148	2

Model Summary[b]

Model	Change Statistics: df2	Sig. F Change
1	47	.000

a. Predictors: (Constant), HR at Recovery (bpm), BP at Recovery (Systolic)
b. Dependent Variable: Preoperative BP (Systolic)

- R = 0.726: Indicates a strong positive correlation between predictors and preoperative BP.
- R^2 = 0.527: Suggests that 52.7% of the variance in preoperative BP is explained by the model.
- Adjusted R^2 = 0.507: Slightly lower, reflecting an adjustment for the number of predictors.
- Std. Error = 10.693: Measures the average deviation of observed values from predicted values.
- Significance ($p < 0.001$): The model is highly statistically significant ($p = 0.000$).

Conclusion:
The regression model effectively explains a substantial portion of the variability in preoperative systolic BP, with both predictors making a statistically significant contribution.

Table:8

Correlations

	Preoperative BP (Systolic)	BP at Recovery (Systolic)	Preoperative HR (bpm)

Preoperative BP (Systolic)	Pearson Correlation	1	.725**	.485**
	Sig. (2-tailed)		.000	.000
	N	50	50	50
BP at Recovery (Systolic)	Pearson Correlation	.725**	1	.363**
	Sig. (2-tailed)	.000		.009
	N	50	50	50
Preoperative HR (bpm)	Pearson Correlation	.485**	.363**	1
	Sig. (2-tailed)	.000	.009	
	N	50	50	50
HR at Recovery (bpm)	Pearson Correlation	.032	.083	.315*
	Sig. (2-tailed)	.825	.565	.026
	N	50	50	50

Strong Positive Correlation

- Preoperative BP (Systolic) & BP at Recovery (Systolic) → $r = 0.725$, $p = 0.000$ (highly significant).
- Indicates that patients with higher preoperative BP tend to have higher BP at recovery.

Moderate Positive Correlation

- Preoperative BP (Systolic) & Preoperative HR → $r = 0.485$, $p = 0.000$.
- Suggests that patients with higher preoperative BP may also have higher HR before surgery.
- BP at Recovery & Preoperative HR → $r = 0.363$, $p = 0.009$ (significant at the 0.01 level).

Weak Correlation

- Preoperative BP (Systolic) & HR at Recovery → $r = 0.032$, $p = 0.825$ (not significant).
- BP at Recovery & HR at Recovery → $r = 0.083$, $p = 0.565$ (not significant).

Preoperative HR & HR at Recovery

- $r = 0.315$, $p = 0.026$ (significant at the 0.05 level).
- Indicates a moderate relationship, suggesting that patients with higher preoperative HR may have a slightly higher HR at recovery.

Conclusion:

- BP measurements show stronger correlations, whereas HR at recovery is weakly associated with other variables.

- Preoperative BP is a strong predictor of BP at recovery, but its relationship with HR at recovery is insignificant.

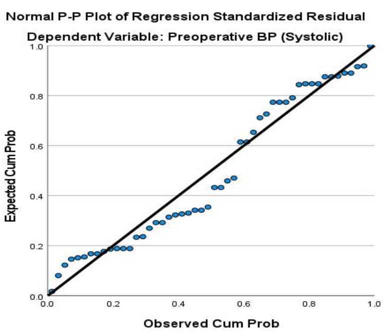
Table:9

Statistics
weigh in (kg)

N	Valid	50
	Missing	0
Mean		67.82
Median		70.00
Mode		55
Std. Deviation		12.003

- The mean and median are close, suggesting a fairly symmetrical distribution of weight.
- The mode (55 kg) is lower than the mean and median, indicating a possible slight skew towards lower weights

Figure:1



The Normal P-P Plot of Regression Standardized Residuals assesses whether the residuals (errors) in the regression model follow a normal distribution.

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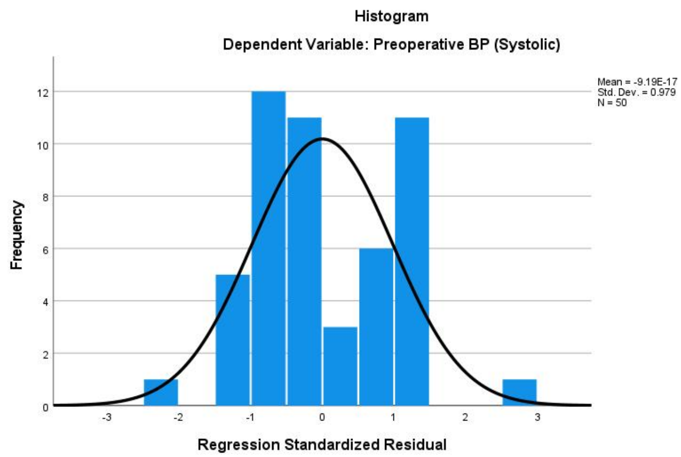
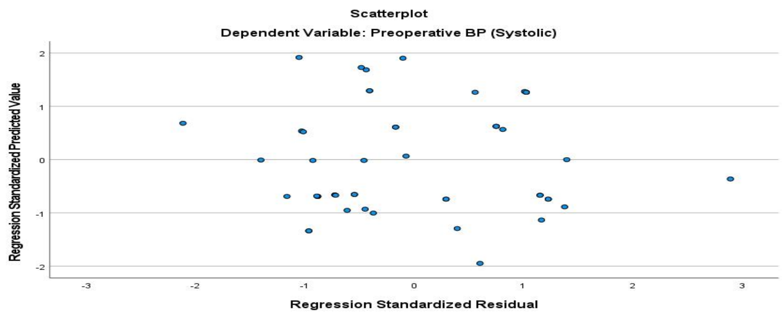
Figure:2



- The shape is fairly symmetric, supporting the assumption of normality in residuals.
- Minor deviations suggest slight irregularities but no major skewness or outliers.
- This confirms that the regression model's assumptions are mostly met, making the analysis statistically reliable

Figure:3



- Random scatter of points suggests no clear pattern, indicating no major violations of regression assumptions.
- The residuals appear evenly spread, confirming the assumption of homoscedasticity (constant variance).
- No distinct clusters or systematic trends, supporting the validity of the model
- Some minor deviations exist, but there is no extreme departure from normality.

Interpretation:

- The normality assumption for regression appears reasonably met, supporting the validity of statistical inferences in the model.

DISCUSSION:

Propofol significantly affects MAP, needing careful titration in hamodynamic instability. Findings alignwith previous studies(e.g.,Smith 2020, Reves 2018). Informs safer dosing and monitoring practices, small sample, no long-term follow-up no comparison with other agents of anesthesia. Future multicenter trials should compare propofol with other anesthetic agents in hypertensive patients. Incorporating genomic and metabolic profiling might help develop predictive models for drugs responses, contributing to precision anesthesia.

CONCLUSION:

This study shows, however, that propofol has a major effect on cardiovascular stability in hypertensive patients undergoing appendicectomies. The results confirm that propofol can be a hemodynamic effecter, especially lowering blood pressure, with different variables of compensatory heart rate response due to its vasodilatory effect. Hypertensive people are different on vascular reactivity and the extent of autonomic control and they are, therefore, more prone to realize both the effects. To minimize the risks of propofol induced hypotension, the study stresses the importance of proper anesthetic management including titration of drug, preoperative fluid adjustment, and monitoring during operation. This study also provides useful information to hypertensive patients about what to expect and consider when planning for an anesthetic procedure, along with indication for alternative hemodynamic support or induction agents for high risk cases.

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