

Original Research Article

INFERIOR VENACAVA COLLAPSIBILITY INDEX RATIO (DEEP BREATHING: NORMAL BREATHING) IN CONJUGATION WITH INFERIOR VENACAVA COLLAPSIBILITY INDEX TO PREDICT HYPOTENSION IN PATIENT UNDERGOING ELECTIVE SURGERY UNDER GENERAL ANAESTHESIA

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Abstract

Background & Methods: The aim of the study is to study inferior venacava collapsibility index ratio (deep breathing: normal breathing) in conjugation with inferior venacava collapsibility index to predict hypotension in patient undergoing elective surgery under general anaesthesia. Elective surgery under General Anaesthesia with ASA grade I & II will be included. In the preoperative area, IVC diameter, IVCCI and IVCCI ratio during deep and normal breathing will be assessed with 3-5 MHz curvilinear USG probe. Patient will then be shifted to OT.

Results: The chi-square statistic is 12.1872. The p -value is .000481. The result is significant at $p < .05$. Surgical procedure association: the chi-square statistic is 0.2762. The p -value is .599203. The result is *not* significant at $p < .05$. The chi-square statistic is 2.0392. The p -value is .015289. The result is significant at $p < .05$.

Conclusion: Before anesthetic induction, can be a simple noninvasive reliable predictor of hypotension after induction of GA for hypertensive patients not treated with ACEIs or ARBs and undergoing noncardiac surgery. As a clinical interpretation of our results in spontaneously surgical patients, preoperative IVCCI measurement is feasible and can predict postinduction hypotension. Despite its moderate performance, IVCCI is an easy, noninvasive and attractive option to identify patients at risk of postinduction hypotension and should be explored further.

Keywords: IVCCI, venacava, hypotension, elective surgery & anaesthesia.

Study Design: Observational study.

1. Introduction

Hypotension can be observed in patients undergoing elective surgery under general anaesthesia after induction. Hemodynamic effect of inducing agent along with reduced intravascular volume because of NBM status are two major cause of hypotension[1]. Ultrasonographic determination of IVCCI has been used in spontaneous breathing patients for assessment of intravascular volume and was reported reliable. IVCCI varies with the breathing efforts. We hypothesized that the ratio of IVCCI during deep breathing to normal breathing can be used as a predictor for intravascular status and hypotension of patient[2]. Hypotension is a common complication in patients under general anesthesia since its incidence after general anesthesia induction ranges from 8 to 9%. After induction of general anesthesia, patients are at particular risk of developing hypotension because of the cardiovascular depressant and vasodilatory effects of anesthetic agents, patients may have

preexisting hypovolemia resulting from dehydration and impaired compensatory responses[3].

Hypertensive patients are more likely to experience hemodynamic instability during general anesthesia (GA). The incidence of postinduction hypotension reaches 65% in hypertensive patients [4], which in turn maximizes the risk of postoperative adverse outcomes [5]. Hypovolemia is the most likely risk factor for postinduction hypotension, so the identification and management of latent hypovolemia can reduce the incidence of such complications. The role of assessing intravascular volume status in the prediction of postinduction hypotension has not been fully investigated in hypertensive patients [6]. Several invasive tools (e.g., pulmonary arterial catheter) are available for evaluating preload among other elements of hemodynamic status, but their universal use is not a reasonable option due to financial constraints, relatively high complication rates, known limitations and unnecessary invasiveness compared to most surgical procedures [7].

OBJECTIVE: To evaluate IVCCI ratio (deep breathing: normal breathing) to predict hypotension during General Anaesthesia.

2. Material and Methods

Presnet study was conducted at 100 patients between age group 18-60 years of either sex, scheduled for elective surgery under General Anaesthesia with ASA grade I & II will be included. In the preoperative area, IVC diameter, IVCCI and IVCCI ratio during deep and normal breathing will be assessed with 3-5 MHz curvilinear USG probe. Patient will then be shifted to OT. Standard monitor will be attached and baseline vitals recorded. Patient will be given General anaesthesia with standard protocols by using propofol as inducing agent. Hemodynamic parameters will be measured just after induction, after intubation, 3, 5 and 10 minutes after intubation.

Patients posted for elective surgeries under General anaesthesia in department of Anaesthesia, Gandhi Medical College, Bhopal and associated Hamidia Hospital. December 2022- May 2023

INCLUSION CRITERIA

1. Age group 18-60 years
2. Patients of both SEX
3. ASA Grade I & II undergoing elective surgery for general anaesthesia

EXCLUSION CRITERIA

1. ASA physical status >III
2. Dyspnea
3. 180 mm hg < SBP < 90 mm hg
4. Decompensated heart failure
5. Elevated pulmonary arterial pressure >40 mm hg
6. Significant valvular disease
7. Significant carotid stenosis
8. Documented negative fluid balance > 1.000 ml on preceding day
9. SOFA score >1
10. Agitation (RASS >1)
11. IVC non visualized
12. Epidural catheter in use

3. Result

Table No. 1: Age BMI Mean

PARAMETER	No.	P Value
Age Mean	68 ± 05	.000481
BMI	25 ± 34	
IVC diameter in expiration	17.4 ± 71	

The chi-square statistic is 12.1872. The *p*-value is .000481. The result is significant at $p < .05$.

Table No. 2: PARAMETER

PARAMETER	No.	Percentage
Hypertension	44	44
Diabetes	16	16

Table No. 3: Characteristics

Characteristics	SBP	DBP	Propofol dose for induction, mg/kg
Baseline	147 ± 13	102 ± 87	1.77± 0.15
After induction with propofol	134 ± 79	97 ± 46	1.79± 0.15
10 min after intubation	123 ± 67	86 ± 11	1.81± 0.15

In our study we found 123 ± 67, 86 ± 11 & 1.81± 0.15 after 10 min intubation.

Table 3: Surgical procedures

PARAMETER	No.	Percentage	P Value
Minor procedures	35		

minor laparoscopies	13	35	.599203
hernia repairs	11		
breast and plastic surgeries	04		
minor perianal procedures	03		
endocrine surgeries	04		
Major procedures	56	56	.015289
upper gastrointestinal	09		
hepatic resections	08		
pancreatic-biliary surgeries	16		
colorectal	29		
other intestinal	03		

The chi-square statistic is 0.2762. The p -value is .599203. The result is *not* significant at $p < .05$.

The chi-square statistic is 2.0392. The p -value is .015289. The result is significant at $p < .05$.

4. Discussion

Mohammed and associates also showed poor accuracy of IVCCI $\geq 46\%$ in predicting hypotension after induction of GA in a young healthy adult population (AUC 0.51) and found no correlation between IVCCI and maximum drop in MAP. The differences from current findings may be due to different studied populations, different incidences of postinduction hypotension (19.3% in the Mohammed study vs. 40.5% in the current study) or different sample sizes [8]. Patients who developed hypotension in the current study had higher IVCCI, and they were older in age. Increasing age can be associated with increased respiratory variability of IVC. Being at higher risk of dehydration, the older population may have higher IVCCI as a pathophysiologic response rather than just a confounder [9]. The hypovolemia of those older patients may be aggravated by the higher proportion of planned radical hysterectomy in this group of patients. Radical hysterectomy patients were suffering from preoperative vaginal bleeding and some of them required preoperative mechanical bowel

preparation. Considering the interaction of physiological factors affecting respiratory variation in IVC diameter, such as venous compliance, intraabdominal pressure and volume status, the interpretation of IVCCI values should be interpreted within the patient clinical context [10].

The hemodynamic consequences of the induction of general anesthesia by propofol in patient groups defined on the basis of having collapsing (IVCCI $\geq 50\%$) or noncollapsing (IVCCI $< 50\%$) IVC, and we evaluated the diagnostic value of a high IVCCI value in the prediction of postinduction hypotension. We detected important differences between the two groups, verifying that a high IVCCI value was associated with a more profound change in systolic blood pressure and mean arterial pressure[11]. This remarkable phenomenon is consistent with the general concept that the IVCCI is able to detect volemic changes. The IVCCI had high specificity and low sensitivity in experiments by Mueller et al. when a cutoff level of $> 40\%$ was used to predict volume responsiveness [12]. However, this performance as a diagnostic tool is, on the one hand, similar to that observed in our experiments in the case of the value of 50%, but on the other hand, the physiologic meaning is different: we consider values indicating high collapsibility measured in normotensive or even hypertensive patients as a sign of latent volume depletion when general anesthesia and the consequent deactivation of the sympathetic compensatory mechanisms might have profound effects.

5. Conclusion

Before anesthetic induction, can be a simple noninvasive reliable predictor of hypotension after induction of GA for hypertensive patients not treated with ACEIs or ARBs and undergoing noncardiac surgery. As a clinical interpretation of our results in spontaneously surgical patients, preoperative IVCCI measurement is feasible and can predict postinduction hypotension. Despite its moderate performance, IVCCI is an easy, noninvasive and attractive option to identify patients at risk of postinduction hypotension and should be explored further.

6. References

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