Section: Anaesthesia

Original Research Article

ROLE OF INFERIOR VENA CAVA COLLAPSIBILITY INDEX IN THE PREDICTION OF HYPOTENSION ASSOCIATED WITH GENERAL ANAESTHESIA

Shaik Vahida[1], Zareena[2], Morla Aparna[3], S Saranya[4]

[1]Associate Professor, Department of Anesthesia, Siddartha Medical College, Vijayawada, Andhrapradesh, India.
[2]Associate Professor, Department of Anesthesia, Siddartha Medical College, Vijayawada, Andhrapradesh, India.
[3]Assistant Professor, Department of Anesthesia, Siddartha Medical College, Vijayawada, Andhrapradesh, India.
[4]3rd Year Post Graduate, Department of Anesthesia, Siddartha Medical College, Vijayawada, Andhrapradesh, India.

Received *: 12/06/2026*
Received in revised form *: 23/07/2026*
Accepted *: 06/08/2026*

Corresponding Author:
Dr. S.Saranya,
3rd Year Post Graduate, Department of Anesthesia, Siddartha Medical College, Vijayawada, Andhrapradesh, India.
Email: drsaranyaanesth@gmail.com

DOI: 10.70034/ijmedph.2026.3.387

Source of Support: Nil,
Conflict of Interest: None declared

Int J Med Pub Health
2026; 16 (3); 2429-2435

ABSTRACT

Background: Post-induction hypotension is a common complication of general anaesthesia and is associated with increased perioperative morbidity. Preoperative identification of patients at risk allows appropriate optimisation of intravascular volume and haemodynamic management. Ultrasonographic assessment of the Inferior Vena Cava Collapsibility Index (IVCCI) is a simple, non-invasive bedside method for estimating volume status. **Aim:** To evaluate the effectiveness of the preoperative Inferior Vena Cava Collapsibility Index in predicting post-induction hypotension in patients undergoing elective surgery under general anaesthesia.

Materials and Methods: This prospective observational study was conducted in the Department of Anaesthesiology, Siddhartha Medical College and Government General Hospital, Vijayawada, from August 2023 to January 2025. Sixty adult patients (ASA I and II) undergoing elective surgery under general anaesthesia were included. Preoperative IVCCI was measured using ultrasonography, and patients were divided into Group C (IVCCI >50%, n=30) and Group NC (IVCCI <50%, n=30). Haemodynamic parameters, fluid requirement, vasopressor requirement, and the diagnostic accuracy of IVCCI for predicting hypotension were analysed.

Results: Baseline characteristics were comparable except for age (p=0.02). Group C demonstrated a significantly greater reduction in systolic blood pressure following induction and intubation (mean SBP decrease: 15.34 ± 8.29 mmHg vs. 6.01 ± 5.50 mmHg; p<0.001). Total intraoperative fluid requirement was significantly higher in Group C (1106.67 ± 234.79 mL vs. 716.67 ± 126.17 mL; p<0.001). Although vasopressor use was more frequent in Group C, the difference was not statistically significant (p=0.07). IVCCI showed a sensitivity of 72%, specificity of 97%, positive predictive value of 70%, negative predictive value of 51%, and an area under the ROC curve of 0.52.

Conclusion: A preoperative IVCCI greater than 50% was associated with greater haemodynamic instability and increased intraoperative fluid requirement following induction of general anaesthesia. Although IVCCI demonstrated high specificity, its overall diagnostic accuracy was modest. IVCCI may serve as a useful adjunct to preoperative assessment but should be interpreted in conjunction with clinical evaluation rather than as a standalone predictor of post-induction hypotension.

Keywords: Inferior vena cava, Collapsibility index, Point-of-care ultrasonography, General anaesthesia, Post-induction hypotension, Fluid responsiveness.

INTRODUCTION

Maintenance of adequate haemodynamic stability during the perioperative period is a primary objective of anaesthetic management. General anaesthesia produces significant physiological changes, including vasodilatation, myocardial depression, and attenuation of sympathetic tone, all of which may result in hypotension immediately after induction. Although transient decreases in blood pressure are common, persistent or severe intraoperative hypotension has been associated with adverse postoperative outcomes such as myocardial injury, acute kidney injury, stroke, postoperative delirium, prolonged hospital stay, and increased short- and long-term mortality. Therefore, early identification of patients at risk of developing post-induction hypotension remains an important component of perioperative care.[1,2]

The occurrence of hypotension following induction of general anaesthesia is multifactorial. Patient-related factors such as advanced age, pre-existing cardiovascular disease, diabetes mellitus, antihypertensive medications, and autonomic dysfunction contribute to the risk. However, one of the most important modifiable factors is inadequate intravascular volume or latent hypovolemia. Patients with occult hypovolemia often maintain normal haemodynamic parameters at rest but may develop significant hypotension after induction because of anaesthesia-induced vasodilatation and reduced venous return. Identification of these patients before induction provides an opportunity for timely fluid optimization and may reduce the incidence of hypotensive episodes.[3,4]

Several invasive haemodynamic monitoring techniques, including pulmonary artery catheterization, pulse contour analysis, and transpulmonary thermodilution systems, have been developed to assess intravascular volume status and fluid responsiveness. Although these techniques provide valuable information, their routine use is limited because of their invasive nature, associated complications, technical complexity, and high cost. Consequently, there is growing interest in reliable, non-invasive bedside methods that can rapidly assess volume status without exposing patients to additional risks.[5]

Point-of-care ultrasonography (POCUS) has emerged as an important extension of the clinical examination in anaesthesia and critical care. Portable ultrasound machines enable rapid assessment of cardiac function, pulmonary pathology, gastric contents, airway anatomy, and intravascular volume status. Among these applications, ultrasonographic evaluation of the inferior vena cava (IVC) has gained considerable attention as a simple and reproducible method for estimating preload.

The inferior vena cava is a highly compliant vessel whose diameter varies during the respiratory cycle. In spontaneously breathing individuals, inspiration decreases intrathoracic pressure, leading to increased venous return and collapse of the IVC. The degree of respiratory variation reflects the patient's intravascular volume status. This variation is quantified using the Inferior Vena Cava Collapsibility Index (IVCCI), calculated from the maximum IVC diameter during expiration and the minimum diameter during inspiration. A higher collapsibility index generally indicates lower circulating blood volume and greater likelihood of fluid responsiveness.

Previous studies have demonstrated that respiratory variation in IVC diameter correlates with fluid responsiveness in both critically ill and perioperative patients. Ultrasonographic measurement of the IVC offers several advantages, including being non-invasive, rapid, repeatable, radiation-free, and easily performed at the bedside. With appropriate training, anaesthesiologists can reliably perform focused IVC assessment within a few minutes, making it a practical tool during routine preoperative evaluation.

Despite increasing use of point-of-care ultrasonography, the ability of preoperative IVC collapsibility index to predict post-induction hypotension in patients undergoing elective surgery under general anaesthesia remains an area of ongoing research. Published studies have shown variable sensitivity and specificity, and differences in patient populations, anaesthetic techniques, and diagnostic cut-off values have limited the generalizability of their findings. Additional evidence from different clinical settings is therefore required to determine its usefulness in routine anaesthetic practice.

The present prospective observational study was undertaken in patients undergoing elective surgery under general anaesthesia to evaluate the role of the preoperative Inferior Vena Cava Collapsibility Index in predicting post-induction hypotension. The study also compared intraoperative fluid requirements, vasopressor use, and haemodynamic changes between patients with high (>50%) and low (<50%) IVC collapsibility indices. The findings of this study may help establish IVCCI as a simple bedside screening tool for identifying patients at increased risk of haemodynamic instability and facilitate individualized perioperative fluid management.

MATERIALS AND METHODS

Study Design

This was a **prospective observational study** conducted in the Department of Anaesthesiology, Siddhartha Medical College and Government General Hospital, Vijayawada, Andhra Pradesh, from **August 2023 to January 2025**.

Source of Data

The study population comprised adult patients posted for elective surgeries under general anaesthesia at Government General Hospital, Vijayawada, during the study period.

Sample Size

A total of **60 patients** were enrolled in the study and were equally divided into two groups based on the preoperative Inferior Vena Cava Collapsibility Index (IVCCI):

Study Group	Inferior Vena Cava Collapsibility Index	Number of Patients
Group C	IVCCI >50% (Collapsing Group)	30
Group NC	IVCCI <50% (Non-collapsing Group)	30
Total		**60**

Sampling Technique

Patients fulfilling the eligibility criteria were recruited using a **random sampling technique** until the required sample size was achieved.

Inclusion Criteria

- Patients aged 18 years and above.
- Patients scheduled for elective surgery.
- Patients undergoing surgery under general anaesthesia.
- American Society of Anesthesiologists (ASA) Physical Status I and II.

Exclusion Criteria

- ASA Physical Status III and above.
- Preoperative systolic blood pressure <90 mmHg or >180 mmHg.
- Patients with severe cardiac disease.
- Patients in whom the inferior vena cava could not be adequately visualized on ultrasonography.

The study was conducted after obtaining approval from the Institutional Ethics Committee. Written informed consent was obtained from all participants after explaining the study objectives and procedures.

Study Methodology

Preoperative Assessment

All patients underwent routine pre-anaesthetic evaluation. Patients were instructed to fast for at least **8 hours** for solids and **4 hours** for clear fluids before surgery.

Ultrasonographic Assessment of Inferior Vena Cava

On arrival in the pre-anaesthetic holding area, patients were positioned supine and allowed to rest for **5 minutes** before ultrasonographic examination.

Inferior vena cava (IVC) assessment was performed using a **2–5 MHz curvilinear ultrasound probe**.

The following measurements were obtained:

- **Maximum IVC diameter (IVCdmax):** measured at end-expiration.
- **Minimum IVC diameter (IVCdmin):** measured at end-inspiration.

The Inferior Vena Cava Collapsibility Index (IVCCI) was calculated using the following formula:

IVCCI (%) = [(IVCdmax − IVCdmin) / IVCdmax] × 100

Based on the calculated IVCCI, patients were allocated into two study groups:

- **Group C (Collapsing Group):** IVCCI >50%
- **Group NC (Non-collapsing Group):** IVCCI <50%

Anaesthetic Technique

After completion of ultrasonographic assessment, patients were shifted to the operating theatre.

Standard monitoring included:

- Electrocardiography (ECG)
- Non-invasive blood pressure (NIBP)
- Pulse oximetry (SpO_2)

Baseline heart rate and blood pressure were recorded before induction of anaesthesia.

An intravenous cannula was secured, and patients received the following premedication:

- Glycopyrrolate 0.005 mg/kg intravenously
- Midazolam 0.01 mg/kg intravenously

General anaesthesia was induced with:

- Fentanyl 1–2 µg/kg intravenously
- Propofol 1.5 mg/kg intravenously

Following induction, tracheal intubation was facilitated using a non-depolarizing neuromuscular blocking agent.

Hemodynamic Monitoring

Heart rate and systolic blood pressure were recorded at the following time points:

- Baseline (pre-induction)
- Two minutes after induction (before tracheal intubation)
- Five minutes after tracheal intubation
- Ten minutes after tracheal intubation

The primary outcome measure was the **change in systolic blood pressure (SBP)** following induction of anaesthesia.

Definition and Management of Hypotension

Hypotension was defined as:

- Systolic blood pressure <90 mmHg.

Significant hypotension was defined as:

- A reduction of more than 30% from baseline systolic blood pressure.

Patients developing significant hypotension were managed with:

- Intravenous crystalloid bolus of 200 mL, followed by
- Intravenous phenylephrine 50–100 µg, whenever required.

Episodes of hypotension, total intraoperative fluid requirement, vasopressor requirement, and vasopressor dose were recorded for analysis.

Outcome Measures

Primary Outcome

- To evaluate the ability of the preoperative Inferior Vena Cava Collapsibility Index to predict post-induction hypotension.

Secondary Outcomes

- Comparison of systolic blood pressure between the two groups.
- Comparison of heart rate changes following induction and intubation.

- Total intraoperative intravenous fluid requirement.
- Requirement for vasopressor administration.
- Total dose of vasopressor administered.
- Diagnostic accuracy of IVCCI in predicting hypotension using Receiver Operating Characteristic (ROC) curve analysis.

Statistical Analysis

The collected data were entered into Microsoft Excel and analysed using **Statistical Package for the Social Sciences (SPSS) version 29.0**.

Descriptive statistics were expressed as mean ± standard deviation for continuous variables and frequencies with percentages for categorical variables.

Inferential statistical tests included:

- **Chi-square test** for comparison of categorical variables.
- **Independent sample t-test** for comparison of continuous variables between the two groups.
- **Receiver Operating Characteristic (ROC) curve analysis** to evaluate the diagnostic accuracy of the Inferior Vena Cava Collapsibility Index in predicting post-induction hypotension.

A **p-value <0.05** was considered statistically significant.

RESULTS

A total of 60 patients were included in the study and were equally divided into Group C (Collapsibility Index >50%, n = 30) and Group NC (Collapsibility Index <50%, n = 30). Baseline demographic characteristics, intraoperative hemodynamic parameters, fluid requirements, vasopressor use, and the diagnostic accuracy of the inferior vena cava collapsibility index (CI) in predicting hypotension were analyzed.

Table 1: Comparison of Age Group between the Study Groups

Age Group (years)	Group C (CI >50)	Group NC (CI <50)	Total
18–30	6	8	14
31–40	5	6	11
41–50	3	7	10
51–60	7	9	16
61–70	9	0	9
Total	**30**	**30**	**60**
Gender			
Female	11	12	23
Male	19	18	37
Weight (kg)			
50–60	12	7	19
60–70	8	10	18
70–80	7	13	20
ASA Physical Status			
I	13	18	31
II	17	12	29
Type of Surgery			
ENT	6	11	17
General Surgery	7	8	15
Orthopaedic	8	8	16
Urology	9	3	12

The age distribution differed significantly between the two groups (p = 0.02). Patients aged 61–70 years were exclusively present in Group C, suggesting that higher collapsibility index values were more common in older individuals.

There was no significant difference in sex distribution between the two groups (p = 0.79). Similarly, weight distribution (p = 0.38), ASA physical status (p = 0.20), and type of surgery (p = 0.20) were comparable between the groups, indicating that baseline demographic and clinical characteristics were well balanced.

Table 2: Comparison of Pulse Rate

Time	Group C Mean ± SD	Group NC Mean ± SD	P-value
Preoperative	83.2 ± 4.7	82.4 ± 5.2	0.15
2 min after induction	84.5 ± 4.5	83.3 ± 5.0	0.22
5 min after intubation	86.0 ± 4.6	84.2 ± 4.8	0.25
10 min after intubation	86.4 ± 4.2	85.2 ± 4.6	0.30

Pulse rate measured preoperatively, 2 minutes after induction, 5 minutes after intubation, and 10 minutes after intubation showed no statistically significant differences between the two groups at any time point (all p > 0.05). This indicates that heart rate remained comparable irrespective of the collapsibility index.

Table 3: Comparison of Preoperative SBP

Variable	Group C	Group NC	P-value
Pre-op SBP (mmHg)	124.52 ± 10.66	124.77 ± 10.74	0.93
SBP 2 Minutes after Induction	113.33 ± 11.09	105.93 ± 12.12	0.02
SBP 5 Minutes after Intubation	108.53 ± 12.10	118.63 ± 12.18	0.002
SBP 10 Minutes after Intubation	113.82 ± 12.58	123.58 ± 13.11	0.004
Mean SBP Decrease	15.34 ± 8.29	6.01 ± 5.50	<0.001

Preoperative systolic blood pressure (SBP) was similar in both groups (124.52 ± 10.66 mmHg in Group C vs. 124.77 ± 10.74 mmHg in Group NC; p = 0.93). However, significant differences emerged after induction and intubation. At 2 minutes after induction, Group C had a higher mean SBP (113.33 mmHg) than Group NC (105.93 mmHg), and the difference was statistically significant (p = 0.02). Five minutes after intubation, Group NC demonstrated a significantly higher SBP (118.63 ± 12.18 mmHg) than Group C (108.53 ± 12.10 mmHg) (p = 0.002). Similarly, at 10 minutes after intubation, SBP remained significantly higher in Group NC (123.58 ± 13.11 mmHg) compared with Group C (113.82 ± 12.58 mmHg) (p = 0.004). The mean reduction in SBP was significantly greater in Group C (15.34 ± 8.29 mmHg) than in Group NC (6.01 ± 5.50 mmHg) (p < 0.001), indicating a greater tendency toward hypotension among patients with a higher collapsibility index.

Table 4: Comparison of Total Fluid Requirement

Variable	Group C	Group NC	P-value
Total Fluid Requirement (mL)	1106.67 ± 234.79	716.67 ± 126.17	<0.001

Patients in Group C required significantly more intraoperative intravenous fluids than those in Group NC (1106.67 ± 234.79 mL vs. 716.67 ± 126.17 mL; p < 0.001). This finding suggests increased fluid requirements in patients with a higher collapsibility index.

Table 5: Comparison of Vasopressor Requirement

Vasopressor	Group C	Group NC	Total
No	12	19	31
Yes	18	11	29
Total	**30**	**30**	**60**

Although vasopressor administration was more frequent in Group C (18 patients) than in Group NC (11 patients), the difference did not reach statistical significance (p = 0.07). mean.

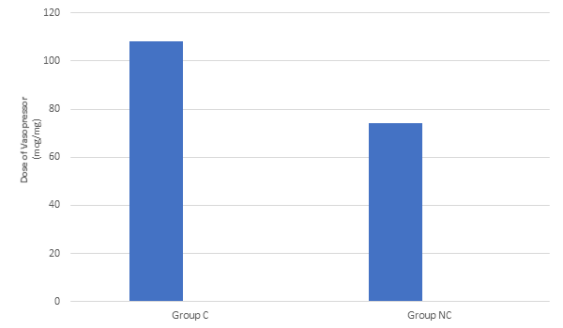

Figure 1: Comparison of Dose of Vasopressor

Vasopressor dose was higher in Group C (108.33 ± 49.93) compared with Group NC (74.00 ± 34.08), but this difference was also not statistically significant (p = 0.20).

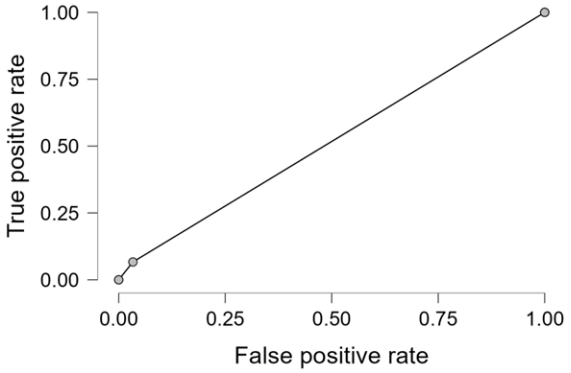

Figure 2: Receiver Operating Characteristic (ROC) Curve for Collapsibility Index in Predicting Hypotension

Sensitivity	**72%**
Specificity	97%
Positive Predictive Value	70%
Negative Predictive Value	51%
Area Under ROC Curve (AUC)	0.52
Overall Accuracy	52%

The diagnostic performance of the inferior vena cava collapsibility index for predicting hypotension demonstrated a sensitivity of 72% and a specificity of 97%. The positive predictive value was 70%, whereas the negative predictive value was 51%. The area under the receiver operating characteristic (ROC) curve was 0.52, with an overall diagnostic accuracy of 52%, indicating that although the

collapsibility index showed high specificity, its overall discriminative ability for predicting hypotension was limited.

DISCUSSION

The present prospective observational study evaluated the role of the preoperative Inferior Vena Cava Collapsibility Index (IVCCI) in predicting post-induction hypotension in patients undergoing elective surgery under general anaesthesia. Sixty patients were divided into two groups based on IVCCI (>50% and <50%), and haemodynamic changes, fluid requirements, vasopressor use, and diagnostic accuracy were assessed.

Demographic Characteristics

The age distribution differed significantly between the two groups, with a greater proportion of patients aged 61–70 years in the high IVCCI group. Similar observations were reported by Isitemiz et al,[6] who demonstrated that elderly patients are more susceptible to hypotension during induction of general anaesthesia because of reduced cardiovascular reserve and impaired autonomic compensation. However, sex, ASA physical status, and type of surgery were comparable between the two groups, which is in agreement with previous studies showing that these factors do not significantly influence IVCCI.

Haemodynamic Changes

Baseline systolic blood pressure was similar in both groups, indicating comparable preoperative haemodynamic status. However, after induction and intubation, patients with IVCCI >50% demonstrated a significantly greater fall in systolic blood pressure than those with IVCCI <50%. The mean decrease in systolic blood pressure was 15.34 mmHg in Group C compared with 6.01 mmHg in Group NC ($p<0.001$). Similar findings were reported by Steinberg et al,[7] and Zhang et al,[8] who concluded that a higher IVCCI is associated with an increased risk of post-induction hypotension because it reflects reduced preload and latent hypovolemia.

The incidence of post-induction hypotension in the present study was 45.8%, which is comparable to the findings of Zhang et al,[8] and lies within the range reported by Louro et al,[9] Purushothaman et al,[10] Szabo et al,[11] and Mohammed et al.[12] Differences in patient characteristics, induction agents, and definitions of hypotension may explain the variation in reported incidence across studies.

Fluid Requirement

Patients with IVCCI >50% required significantly larger volumes of intraoperative intravenous fluids than those with IVCCI <50% (1106.67 mL vs. 716.67 mL; $p<0.001$). This finding supports the physiological concept that increased IVC collapsibility indicates reduced intravascular volume and greater fluid responsiveness. Similar observations have been reported in studies evaluating IVCCI as a marker of preload and volume responsiveness in spontaneously breathing patients.

Vasopressor Requirement

Although vasopressor use was more frequent in patients with IVCCI >50%, the difference was not statistically significant ($p=0.07$). Likewise, the mean vasopressor dose was higher in Group C but did not reach statistical significance. Similar findings have been reported in previous studies, suggesting that prompt fluid replacement during anaesthesia may reduce the need for vasopressors despite greater haemodynamic fluctuations in patients with higher IVCCI values.

Diagnostic Accuracy of IVCCI

In the present study, IVCCI demonstrated a sensitivity of 72% and specificity of 97% for predicting post-induction hypotension, with an AUC of 0.52. The high specificity indicates that patients with IVCCI >50% are more likely to develop hypotension, whereas the relatively low AUC suggests limited diagnostic performance when IVCCI is used as a standalone predictor. Fathy et al,[13] reported higher diagnostic accuracy (AUC 0.908), whereas Liu et al,[14] observed poor predictive performance (AUC 0.54). These variations are probably attributable to differences in patient population, ultrasound methodology, respiratory pattern, anaesthetic technique, and IVCCI cut-off values.

Clinical Implications

The findings of the present study suggest that preoperative IVCCI measurement is a simple, rapid, and non-invasive bedside investigation that can identify patients at increased risk of post-induction haemodynamic instability. Patients with higher IVCCI may benefit from preoperative optimisation of intravascular volume and closer haemodynamic monitoring during induction of general anaesthesia. However, considering its modest overall diagnostic accuracy, IVCCI should be used as an adjunct to clinical assessment rather than as an independent predictor of hypotension.

Overall, the present study supports the growing evidence that preoperative assessment of the Inferior Vena Cava Collapsibility Index is useful for identifying patients who are more likely to experience significant haemodynamic changes following induction of general anaesthesia and who may require greater intraoperative fluid support.

CONCLUSION

This study demonstrated that preoperative ultrasonographic assessment of IVC to evaluate its collapsibility index is a convenient and reproducible tool for prediction of hypotension subsequent to the induction of general anaesthesia. The current investigation indicates that Group C whose collapsibility index >50 is correlated with a more significant reduction in systolic blood pressure and elevated fluid demands when compared with Group

NC. There was also an increased requirement of vasopressor administration in group C but it was statistically insignificant.

It is imperative that additional multicentric, large-scale investigations employing standardised methodologies be conducted to corroborate these findings and to establish universally recognised cut-off values for IVCCI in the context of predicting hypotension induced by anaesthesia. When approached with careful consideration and contextual awareness, IVCCI has the potential to markedly improve anaesthetic safety and facilitate tailored management for patients.

REFERENCES

1. Walsh M, Devereaux PJ, Garg AX, Kurz A, Turan A, Rodseth RN, et al. Relationship between intraoperative mean arterial pressure and clinical outcomes after noncardiac surgery: toward an empirical definition of hypotension. Anesthesiology. 2013;119(3):507–515.
2. Salmasi V, Maheshwari K, Yang D, Mascha EJ, Singh A, Sessler DI, et al. Relationship between intraoperative hypotension, defined by either reduction from baseline or absolute thresholds, and acute kidney and myocardial injury after noncardiac surgery. Anesthesiology. 2017;126(1):47–65.
3. Miller RD, Cohen NH, Eriksson LI, Fleisher LA, Wiener-Kronish JP, Young WL. Miller's Anesthesia. 9th ed. Philadelphia: Elsevier; 2020.
4. Cecconi M, De Backer D, Antonelli M, Beale R, Bakker J, Hofer C, et al. Consensus on circulatory shock and hemodynamic monitoring. Intensive Care Med. 2014;40(12):1795–1815.
5. Ferreira AC, et al. Impact of perioperative point-of-care ultrasound on anaesthetic management: A systematic review and meta-analysis. J Clin Anesth. 2021;68:110090.
6. Isitemiz I, et al. Predictors of hypotension during induction of general anesthesia in elderly patients. Turk J Anaesthesiol Reanim. 2014;42(4):213–219.
7. Steinberg JH, et al. Inferior vena cava collapsibility predicts propofol-induced hypotension during induction of general anesthesia. J Clin Monit Comput. 2020;34(5):1013–1020.
8. Zhang J, Critchley LAH, et al. Inferior vena cava collapsibility index predicts hypotension after induction of general anesthesia in spontaneously breathing patients. BMC Anesthesiology. 2021;21:120.
9. Louro M, et al. Incidence and predictors of post-induction hypotension in patients undergoing elective surgery under general anesthesia. Eur J Anaesthesiol. 2018;35(Suppl 56):128.
10. Purushothaman S, et al. Incidence and predictors of post-induction hypotension in elective surgical patients. Indian J Anaesth. 2020;64(8):670–676.
11. Szabó M, et al. Incidence and risk factors for post-induction hypotension in non-cardiac surgery. Acta Anaesthesiol Scand. 2019;63(4):497–505.
12. Mohammed S, et al. Predictors of post-induction hypotension among patients undergoing elective surgery under general anesthesia. Saudi J Anaesth. 2022;16(2):161–167.
13. Fathy A, Mohamed M, Ahmed A, et al. Inferior vena cava collapsibility index as a predictor of post-induction hypotension in hypertensive patients undergoing non-cardiac surgery. BMC Anesthesiology. 2023;23:196.
14. Liu Y, et al. Predictive value of inferior vena cava collapsibility index for hypotension in elderly patients undergoing hip arthroplasty under combined anesthesia. BMC Anesthesiology. 2024;24:56.