International Journal of Medical and Pharmaceutical Research

Online ISSN-2958-3683 | Print ISSN-2958-3675
Frequency: Bi-Monthly
Website: https://ijmpr.in/

Original Research Article

Study Of Requirement Of Vasopressors And Side Effect Of Preloading Versus Co-Loading Using Crystalloids And Colloids During Elective LSCS Under Spinal Anaesthesia

Harshita Muralidhar[1], Jyothi Sheelavantar[2], Shilpa Wali[3]

[1]Senior Resident, Department of Anaesthesiology , Gulbarga Institute of Medical Sciences, India
[2]Senior Resident, Department of Anaesthesiology, Mahadevappa Rampure Medical College, India
[3]Senior resident, Department of Anaesthesiology, ESIC Gulbarga, India

OPEN ACCESS

Corresponding Author:

Shilpa Wali
Senior resident, Department of Anaesthesiology, ESIC Gulbarga, India.

Received: 09-07-2025
Accepted: 20-08-2025
Published: 31-08-2025

ABSTRACT

Objective: The present study was conducted among 120 parturient, with the objective to evaluate the effect of preload and coload of crystalloids versus colloid requirement of Intravenous Fluids , vasopressor usage , side effects and neonatal outcomes.

Methods: This Prospective randomized comparative study was carried out over a period of 18 months from 1st March 2023 to 30 September 2024 at KBN Teaching and General Hospital attached to FOMS, KBNU. After approval from the institutional ethics committee, 120 patients of ASA II with full term pregnancy scheduled for elective caesarean section fulfilling inclusion criteria were enrolled in the study.

Result: There was statistically significant difference in the occurrence of nausea, vomiting and hypotension across the four groups which was maximum among the PR and CR in comparison to PH and CH groups. Respiratory depression and bradycardia were documented among PR and CR group but the difference was not statistically significant. The mean values of APGAR were similar across all four group at both 1 min and 5 minutes with no statistically significant difference (p=1.00)

Conclusion: Incidence of hypotension was much more among the crystalloid than colloid group. The need for vasopressor was maximum among the preload crystalloid group followed by coload crystalloid group than less in preload colloid and coload colloid. The side effects such as nausea and vomiting were higher among the crystalloid group than the colloid group.

Keywords*: Elective LSCS, Spinal Anaesthesia, side effects.*

INTRODUCTION

Maternal hypotension commonly occurs following spinal anesthesia for cesarean delivery. The prevention and management of post-spinal hypotension (PSH) in these cases have been extensively studied.

Spinal anaesthesia is frequently used for caesarean sections due to its rapid onset and, dense neural block. It is associated with reduced maternal morbidity and mortality—primarily because it decreases the risk of pulmonary aspiration and failed intubation. Additionally, it prevents neonatal exposure to depressant anaesthetic drugs and allows the mother to remain awake during delivery.

Postspinal hypotension mainly results from sympathetic inhibition, which causes venous pooling and peripheral vasodilation. Consequently, there is a decrease in both cardiac output and venous return, leading to hypotension[1]. Pregnant women undergoing cesarean section—with spinal blocks reaching up to the 4th thoracic dermatome—are particularly susceptible to hypotension. Additionally, those experiencing aortocaval compression, combined with a reduced responsiveness to endogenous vasoconstrictors and an increased production of endothelium-derived vasodilators, are at a heightened risk of developing hypotension[1,2].

Crystalloids are aqueous solutions, consisting of inorganic ions, such as sodium, chloride, and sometimes potassium, calcium, and magnesium, as well as in some cases small organic molecules such as dextrose, lactate, acetate, or

gluconate.[3,4,,5] Crystalloids are available as isotonic, hypotonic, and hypertonic solutions.[4] Physiologic solutions contain ions such as potassium and more closely resemble the intravascular composition.

There are several advantages and disadvantages to intraoperative crystalloids. Crystalloids are generally safe, are inexpensive, and do not share the same concerns as colloids, which include anaphylaxis and coagulopathy. Crystalloids remain in the intravascular component for a shorter amount of time as compared to colloid solutions. Isotonic fluids redistribute along the various fluid compartments and therefore larger volumes of crystalloid are needed to replace blood loss. As mentioned earlier, only approximately 20–30% of an isotonic crystalloid solution remains in the intravascular space. Consequently, tissue edema is a potential side effect of administering high volumes of crystalloid, such as 4–5 L, rapidly.[4,5]

As compared to crystalloids, colloids have different properties. One advantage of colloids is that they remain in the intravascular space for longer periods of time with less risk of peripheral and pulmonary edema.[4] Commonly used colloids include albumin, hydroxyethyl starch, and dextran. Disadvantages include increased cost and risks for hypersensitivity reactions, coagulopathy, and renal failure.[3,6,7,8] Colloids expand the volume of the intravascular space, resulting in dilution of blood cells, platelets, and coagulation factors.[3,9]

Hence, this study was designed to evaluate the effect of preload and coload of crystalloids versus colloid requirement of Intravenous Fluids, vasopressor usage, side effects and neonatal outcomes in patients undergoing elective cesarean sections following spinal anesthesia.

MATERIAL AND METHODS

This Prospective randomized comparative study was carried out over a period of 18 months from 1st March 2023 to 30 September 2024 at KBN Teaching and General Hospital attached to FOMS, KBNU. After approval from the institutional ethics committee, 120 patients of ASA II with full term pregnancy scheduled for elective caesarean section fulfilling inclusion criteria were enrolled in the study.

Written informed consent was obtained for all patients participating in the study.

Inclusion criteria:

1. Gravida with term gestation
2. Single term pregnancy
3. ASA physical status 2 undergoing elective LSCS under spinal anaesthesia
4. Normal fetal heart rate
5. Height > 150 cms to <160 cms
6. Age group 18 -30 years

Exclusion criteria

1. Complicated pregnancy
2. Multiple gestation
3. Preterm gestation
4. Drug allergz
5. Contraindications to neuraxial analgesia

Sample size: 120

GROUP PR -30 GROUP CR-30 GROUP PH -30 GROUP CH -30 GROUPS:

Group PR - Parturient has been Preloaded with 10ml/kg of RL over 30 min prior to spinal anaesthesia(N = 30)

Group CR - Parturient has been Co-loaded with 10ml/kg of RL within 20 min following spinal anaesthesia(N = 30)

Group PH - Parturient has been Preloaded with 10ml/kg of 6% HES(molecular weight 130) over 30 min prior to spinal anaesthesia(N = 30)

Group CH - Parturient has been Co-loaded with 10ml/kg of 6% HES within 20 min following spinal anaesthesia(N = 30).

Randomly allocated to either of 4 study goups using computer generated table of random number at the time of pre-anaesthesia evaluation

Preoperative Assessment: Patient history, general and systemic examination, and routine investigations were conducted. Informed consent was obtained.

Procedure: . After an overnight fast, all parturients were pre-medicated in the ward with 50 mg of Inj. Ranitidine i.v. administered 45 minutes prior to being transferred to the operation theatre.

. An 18-gauge cannula was inserted for intravenous access in the hand.

.Parturients were randomly assigned to four study groups using a computer-generated program.

For the patients in **Group PR & PH**, 10 ml/kg of Ringer's Lactate crystalloid and 6% HES colloid were administered, respectively, over a period of 30 minutes before spinal anesthesia.

- The parturient was transferred to the operating room and positioned supine with a slight left lateral tilt on the operating table.
- Oxygen was administered at a rate of 4-6 l/min via a face mask.
- The parturient's baseline heart rate, blood pressure, respiratory rate, and oxygen saturation (SpO2) were recorded preoperatively using a multi-parameter monitor.
- The parturient was then turned to the left lateral position.
- Under strict aseptic technique, spinal anesthesia was performed using a 25-gauge Quincke's needle, injecting 2.0 ml of 0.5% hyperbaric bupivacaine into the subarachnoid space at the L3-L4 intervertebral space.
- The parturient was then placed supine with a slight left lateral tilt 15degree.
- For **Group CR & CH**, 10 ml/kg of Ringer's Lactate crystalloid and 6% HES(MW 0.3) 10 ml/kg colloid were administered over 20 minutes immediately following spinal anesthesia.
- The level of the block was assessed 5 minutes after the spinal anesthesia by the bilateral pin-prick method along the midclavicular line using a 26 G hypodermic needle.
- All parturients received oxygen at a rate of 4-6 lpm via a face mask.
- The skin incision time and baby delivery time were recorded.
- Upon delivery of the baby, 10 units of oxytocin were administered through a separate intravenous line given.
- If the systolic blood pressure (SBP) decreased by 20% of the baseline value, 6 mg of Inj. Mephentermine was administered intravenously as a vasopressor.
- After the procedure, the parturient was transferred to the recovery room.
- Additional intravenous fluid was given based on patient requirement and was noted.

Parameters Assessed:

- The total vasopressor requirement was recorded.
- The occurrence of side effects such as nausea, vomiting, excessive bleeding, respiratory depression and allergic reactions to intravenous fluids was noted.
- Neonatal assessment was conducted using APGAR scores at 1 minute and 5 minutes after birth.

Side Effects: Parturients were closely monitored for side effects such as nausea, vomiting, respiratory depression, excessive bleeding, allergic reactions, pruritus, and bradycardia. Appropriate treatments were administered as needed.

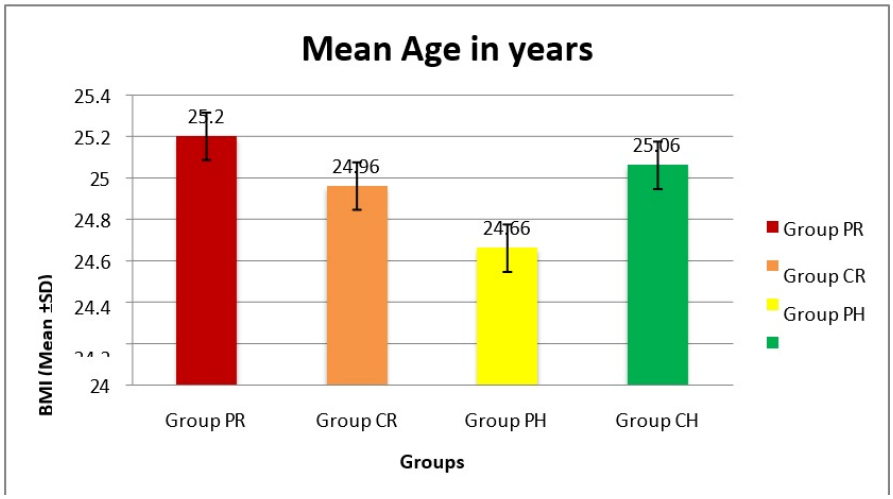
Statistical analysis

Data has been analysed by using ibmspss 25.0 version software. For qualitative data analysis chi square test and fisher exact test are applied. For quantitative data analysis paired and unpaired test are applied . T test are applied for statistical significance. If prevalence is <0.05 is considered as significant

RESULTS

The mean age distribution among the four groups were similar with no significant difference (p>0.05)

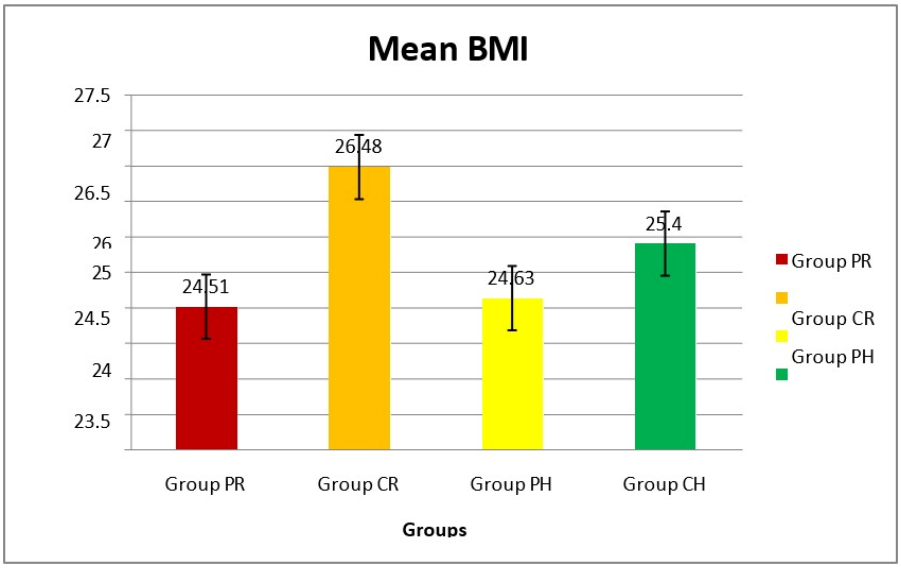
Figure 1: The mean age of study participants in the four groups (N=120)



BMI

The mean Body Mass Index (BMI) of the four study group were compared and found to be similar (p=0.89).

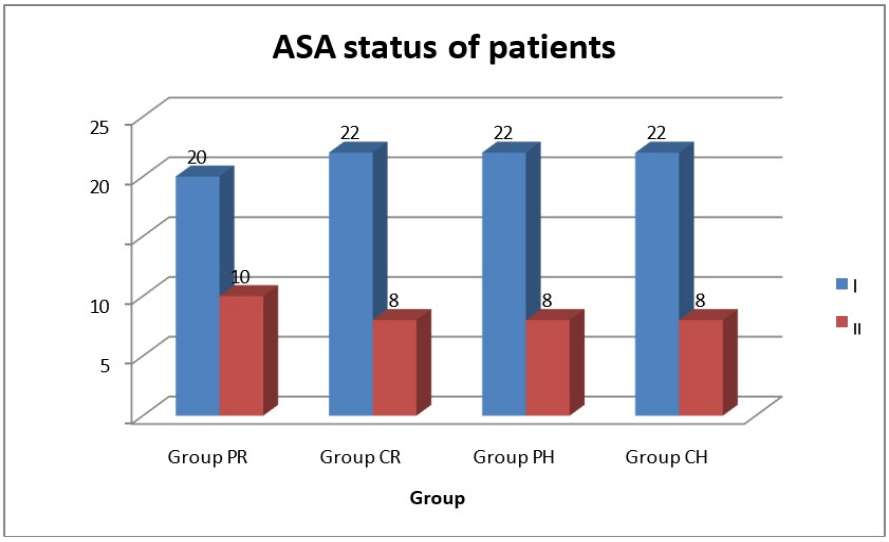
Figure 2: The mean BMI of study participants in the four groups (N=120)



SA Status

The ASA status of all study participants were either I or II. This distribution between the two groups were similar. (p=1.00)

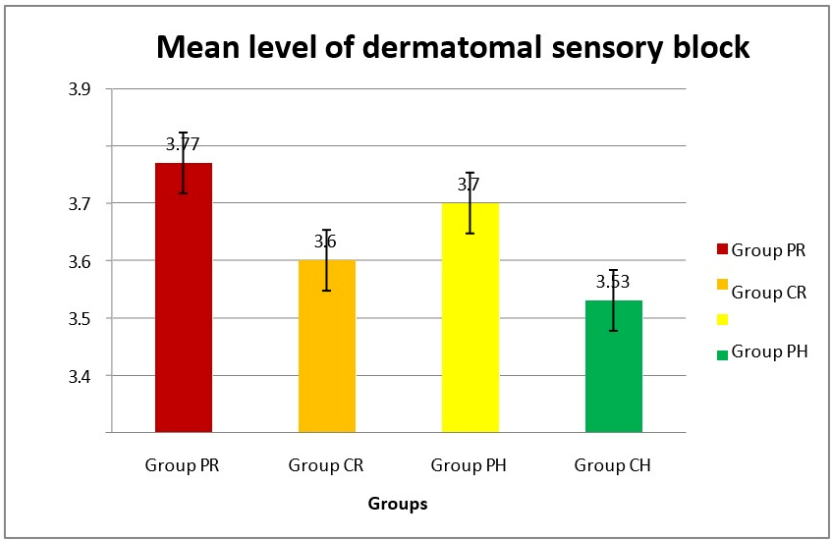
Figure 3: The ASA status of study participants in the four groups (N=120)



Maximum dermatomal level of sensory block

Highest dermatomal level of block achieved in all participants was either 3 or 4 thoracic dermatome. The mean level of block was similar among the four with no statistical significant difference. (p=0.96).

Figure 4: The mean level of maximum dermatomal sensory block (N=120)



Intravenous fluid requirement

The mean volume of IVF required for each of the four groups PR, CR, PH and CH were 1,711.67 ml, 1,731.66 ml, 1,658.33 ml and 1,605.10 ml respectively. The requirement was more among the PR and CR group when compared to the PH and CH group. This difference in IVF required among the four was found to be statistically significant ($p<0.03$).

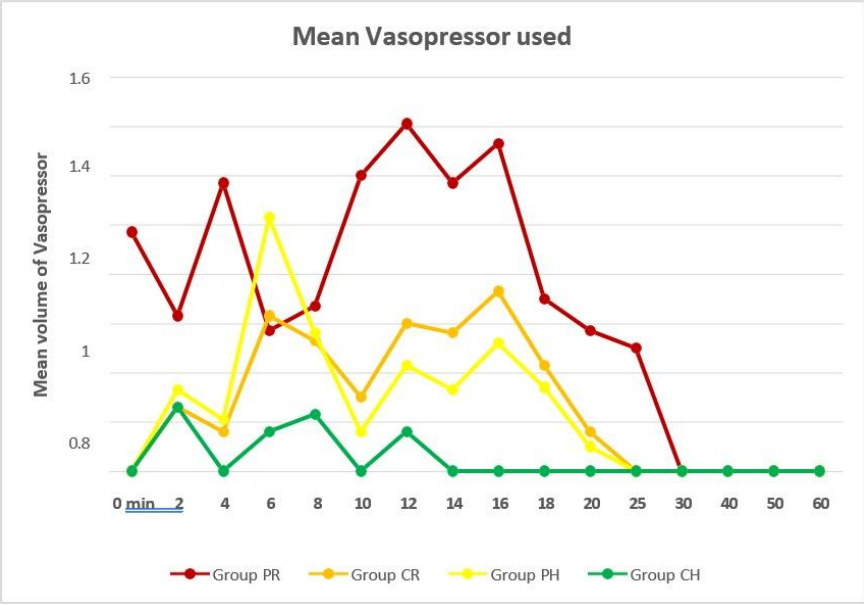
Table 1: Comparison of mean volume of total intravenous fluids used across the four groups (N=120)

IVF (ml)	Group PR	Group CR	Group PH	Group CH	P- value
Mean ± SD	1711.67 ± 160.1	1731.66 ± 163.2	1658.33 ± 183.5	1605.10 ± 195.8	0.03*

Vasopressor used

At baseline itself vasopressor was given for PR group. The requirement of vasopressor use was maximum among the PR group followed by CR, PH and CH. This difference in vasopressor used was statistically significant at 4 mins (p=0.00), 10 mins (p=0.02), 14 mins (p=0.01) and 16 mins (p=0.00)

Figure 5: The mean bolus dose of vasopressor used in the four groups (N=120)



Side-effects

Table 2: Comparison of side effect in the four groups (N=120)

Side effect	Group PR	Group CR	Group PH	Group CH	P- value
Nausea	14 (46%)	7 (23.3%)	4 (13.3%)	1(3.3%)	0.00*

Vomiting	10 (33.3%)	9 (30.0%)	4 (13.3%)	1(3.3%)	0.01*
Hypotension	19 (63.3%)	5 (16.6%)	3 (10.0%)	1(3.3%)	0.00*
Respiratory depression	2 (6.6%)	1 (3.3%)	1 (3.3%)	0 (0%)	0.89
Bradycardia	2 (6.6%)	1 (3.3%)	0 (0%)	0 (0%)	0.90

*Statistically significant

The side effects reported among the participants of all the four group were documented. The side effects reported were nausea, vomiting, hypotension, respiratory depression and bradycardia. There was statistically significant difference in the occurrence of nausea, vomiting and hypotension across the four groups which was maximum among the PR and CR in comparison to PH and CH groups.

Neonatal outcome

The APGAR score of all new born were noted at 1 min and 5 minutes post-delivery. The mean values were similar across all four group at both 1 min and 5 minutes with no statistically significant difference (p=1.00)

Table 3: Comparison of neonatal outcome (APGAR score) in the four groups (N=120)

APGAR score	Group PR	Group CR	Group PH	Group CH	P- value
1 min	8.40 ± 0.67	8.36 ± 0.61	8.66 ± 0.47	8.26 ± 0.69	1.00
5 mins	9.63 ± 0.49	9.70 ± 0.46	9.56 ± 0.50	9.70 ± 0.46	

DISCUSSION

The study participants were divided into four groups of 30 each. i.e. preload with RL (Group PR), co-load with RL (Group CR), preload with HES (Group PH) and co-load with HES (Group CH).volume infused was 10ml/kg.

All the baseline parameters such as age, BMI, ASA status and level of sensory block were comparable among the four groups making comparison between them valid.

Total vasopressor usage

The requirement of vasopressor use was maximum among the PR group followed by CR, PH and CH. This difference in vasopressor used was statistically significant at 4 mins (p=0.00), 10 mins (p=0.02), 14 mins (p=0.01) and 16 mins (p=0.00)

Ah-Young et. al. [10] compared the effect of preload and co-load of crystalloids and found that preload required more amount of vasopressor than co-load with crystalloids similar to our findings.

Rohit Varshney et. al. in their study compared pre load and co loading colloid HES found that coloaded colloid required more bolus of vasopressor than preload but the difference was not significant (p>0.05)

Arora et. al. [11] in their study compared colloid pre and coload with crystalloid pre-load found the requirement of bolus dose of vasopressors was found to be more among the crystalloid preload group in comparison to both pre and coload of colloid group similar to our study.

Total IV Fluids usage

The IVF requirement was more among the PR and CR group when compared to the PH and CH group. This difference in IVF required among them was found to be statistically significant (p<0.03).

Parul Jain et.al. in their study comparing pre and coload of crystalloid found the fluid requirement among both groups to be similar with no significant difference similar to our study.

Side effects

There was statistically significant difference in the occurrence of nausea, vomiting and hypotension across the four groups which was maximum among the PR and CR in comparison to PH and CH groups.

Ah-Young et. al. [10] compared the effect of preload and co-load of crystalloids and found the incidence of nausea to be more among the preload group (60%) than coload group (27%) and the difference was statistically significant (p=0.01). But there was no incidence of vomiting among participants of both groups.

Artawan et. al. compared pre and coload of crystalloid with control group. Their study found the incidence of nausea and vomiting to be more in preload group (10%) than coload group (0%). But the incidence of nausea and vomiting was more

among the control group (90%) (i.e. receiveing no crystalloids) and difference between them was statistically significant (p=0.03).

Neonatal outcome
The mean APGAR scores were similar across all four group at both 1 min and 5 minutes with no statistically significant difference (p=1.00)

Parul Jain et.al. in their study comparing pre and coload of crystalloid found the mean APGAR score between the two groups to be similar with no statistically significant difference. Even Ah-Young et. al. [10] comparing the effect of preload and co-load of crystalloids found no difference in APGAR score across the two groups. Even Amanda et. al. [3] reported similar findings.

Rohit Varshney et. al. in their study compared pre and coloading with colloid HES They also found no difference in the neonatal outcome like APGAR score, birth weight and acid-base status between them.

Present study had several limitation, the lack of control group or placebo group predicted determination of an absolute reduction in the incidence of hypotension.

APGAR score was taken for rapid evaluation of fetal outcome in place of umbilical blood ph and blood gas status, which could have given more accurate physiological effects of spinal anaesthesia induced hypotension on fetus.

Conclusion: In our study, we found the incidence of hypotension was much more among the crystalloid than colloid group. Among the crystalloid and colloid group co-loading found to be better than preloading in terms of hypotension and also side effects. The intravenous fluids requirements were more among the pre-load group than coload group. The need for vasopressor was maximum among the preload crystalloid group followed by coload crystalloid group than less in preload colloid and coload colloid. The side effects such as nausea and vomiting were higher among the crystalloid group than the colloid group

REFERENCES

1. Bajwa SJ, Kulshrestha A, Jindal R. Co-loading or pre-loading for prevention of hypotension after spinal anaesthesia! a therapeutic dilemma. Anesthesia, essays and researches. 2013 May;7(2):155.
2. Tawfik MM, Hayes SM, Jacoub FY, Badran BA, Gohar FM, Shabana AM, Abdelkhalek M, Emara MM. Comparison between colloid preload and crystalloid co-load in cesarean section under spinal anesthesia: a randomized controlled trial. International journal of obstetric anesthesia. 2014 Nov 1;23(4):317-23.
3. Grocott MP, Mythen MG, Gan TJ. Perioperative fluid management and clinical outcomes in adults. AnesthAnalg. 2005;100:1093–1106.
4. Stoelting RK, Miller RD. Basics of Anesthesia. 5th ed. Philadelphia, Pa: Churchill Livingstone Elsevier;; 2007.466-467
5. Morgan GE, Mikhail MS, Murray MJ. Clinical Anesthesiology. 4th ed. New York, NY: McGraw-Hill Companies;; 2006.584-590
6. Bailey AG1, McNaull PP, Jooste E, Tuchman JB. Perioperative crystalloid and colloid fluid management in children: where are we and how did we get here? AnesthAnalg. 2010;110:375–390.
7. Frost P. Intravenous fluid therapy in adult inpatients. BMJ. 2015 .25-35
8. Mitra S, Khandelwal P. Are all colloids same? How to select the right colloid? Indian J Anaesth. 2009;53:592–607.
9. Gondos T1 Marjanek Z, Ulakcsai Z. et al. Short-term effectiveness of different volume replacement therapies in postoperative hypovolaemic patients. Eur J Anaesthesiol. 2010;27:794–800.
10. Oh AY, Hwang JW, Song IA, Kim MH, Ryu JH, Park HP, Jeon YT, Do SH. Influence of the timing of administration of crystalloid on maternal hypotension during spinal anesthesia for cesarean delivery: preload versus coload. BMC Anesthesiol. 2014 May 16;14:36.
11. Arora P, Singh RM, Kundra S, Gautam PL. Fluid administration before caesarean delivery: does type and timing matter?. Journal of clinical and diagnostic research: JCDR. 2015 Jun;9(6):UC01.