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TO STUDY THE CORRELATION BETWEEN PREOPERATIVE INFERIOR VENA CAVA DIAMETER AND INTRAOPERATIVE HYPOTENSION DURING SPINAL ANAESTHESIA IN CAESAREAN SECTION.

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ABSTRACT

BACKGROUND: Assessment of maternal intravascular volume status during and after gestation is most crucial in the setting of complications that affect hemodynamic stability. The goal of the perioperative fluid management is to avoid acute kidney injury due to hypovolemia and hypotension due to spinal anaesthesia. Ultrasound measurements of dynamic change in inferior vena cava diameter (IVC) and collapsibility index are used to predict and prevent the hypotension after spinal anaesthesia.

OBJECTIVES: To correlate the IVC diameter in expiration and incidences of intraoperative hypotension after spinal anaesthesia in full term pregnant patients posted for elective caesarean section.

MATERIALS AND METHOD: Total 50 young female patients having full term pregnancy scheduled for elective caesarean sections were included in the study after taking informed consent. Preoperative assessment of all patients was done. Preoperative inferior vena cave diameter in expiration was measured by ultrasound guidance by subcostal approach. Spinal anaesthesia was given with injection bupivacaine heavy 0.5% 2ml between L3-L4 subarachnoid space after taking all aseptic precaution. Pulse, blood pressure was measured at regular interval. Incidence of intraoperative hypotension, bradycardia was noted. Results were expressed as mean ±SD and analysed by paired' test and correlation coefficient was calculated.

RESULTS: The mean inferior vena cava diameter in expiration was 17.4 ± 0.04 and collapsibility index was less than 36 in 80% of patients, and only one patient had developed hypotension after spinal anaesthesia. Correlation coefficient was -0.9.

CONCLUSION: Preoperative inferior vena cava measurement is a reliable predictor of hypotension after spinal anaesthesia.

KEYWORDS: Ultrasound, IVC collapsibility index, pregnant patients, spinal anaesthesia

INTRODUCTION:

Adequate fluid management in intraoperative period is a challenging issue in both critically ill patients and during major surgery. Ultrasound measurements of dynamic changes in inferior vena cava diameter (IVC) and collapsibility index are used to estimate the fluid responsiveness and intravascular volume status. Ceruti et al studied the ultrasound guided fluid therapy for prevention of hypotension and suggested that fluid therapy guided by IVC ultrasound may help to optimize fluid status before spinal anaesthesia. [(1)] Central venous or pulmonary artery catheters can be useful to evaluate intravascular volume, but these techniques are invasive and associated with risks. Assessment of maternal intravascular volume status during and after gestation is most crucial in setting of complications that affects hemodynamic stability [(2)]. A sonographic measurement of the inferior vena cava

diameter is a useful tool in emergency and critical care settings for non-invasive acute and serial assessment of intravascular status. The purpose of the perioperative fluid management is to avoid acute kidney injury and hypotension due to hypovolemia [3]. The diameter of the inferior vena cava increases when total blood volume increases and decreases when total blood volume decreases. The IVC diameter is a reflection of right atrial pressure which measures cardiac preload. Thus, this study was planned to correlate the size of IVC diameter and intraoperative hypotension after spinal anaesthesia in full term pregnant patients posted for caesarean section.

AIMS AND OBJECTIVES:

The aim of the present study was

1. To determine the inferior vena cava diameter measurements in pregnant patients who undergo caesarean section under spinal anaesthesia.
2. To correlate the diameter of inferior vena cava with incidence of hypotension after spinal anaesthesia for caesarean section.

INCLUSION CRITERIA:

All full term pregnant female patients of ASA grade I and II, aged between 20 – 40 years, primigravida, posted for caesarean section under spinal anaesthesia.

EXCLUSION CRITERIA:

1. Those taking antihypertensive medication,
2. Patients with history of sensitivity to drugs used in study.
3. Emergency caesarean section.
4. Patients who gave negative consent.
5. A pregnant female patient with cardiac, hepatic, renal disease, chronic hypertensive, preeclampsia, multiple gestations, abnormal placentation.

MATERIALS AND METHOD:

This observational prospective study was conducted in total 50 adult full term pregnant female patients aged between 20-40 years of ASA grade I and II, primigravida posted for elective caesarean section. Preoperative assessment of all patients was done and kept NBM for 8hrs. Standard monitors like ECG, NIBP, pulse -oximeter were applied. IV line was taken and inj. RL started. Preoperative inferior vena cava diameters were measured by ultrasound guidance by subcostal approach. Inferior vena cava diameter in expiration (maximum) and in inspiration (minimum) was measured. Collapsibility index was calculated.

COLLAPSIBILITY INDEX: [CI]

$$CI = \frac{\text{Expiration diameter} - \text{Inspiration diameter}}{\text{Expiration diameter}} * 100$$

ANESTHESIA TECHNIQUE:

Spinal anaesthesia was given with injection bupivacaine heavy 0.5% 2ml intrathecally in between L3 – L4 space after taking all aseptic and antiseptic precaution.

PARAMETERS OBSERVED:

Parameters like heart rate, systolic blood pressure, respiratory rate, SPO2 recorded at baseline, after spinal anaesthesia and then every 5 min till the end of surgery. Incidences of hypotension occurred during surgery were recorded. Side effects like bradycardia, nausea, vomiting, shivering also recorded. Bradycardia means heart rate

less than 60, was treated with inj. Atropine 0.6mg IV and hypotension means decreases in BP more than 20% from the baseline, was treated with IV fluids and if needed inj. Ephedrine 5mg IV.

STATISTICAL ANALYSIS:

Data were expressed as mean ± standard deviation or numbers and percentages. Analysis of data was done by using paired t- test. Correlation coefficient was calculated. Microsoft Office Excel 2010 was used.

CORRELATION COEFFICIENT:

Correlation coefficient normal range between +1 to -1.

1. 0 means no correlation.
2. +1 means perfect positive correlation.
3. -1 means perfect negative correlation.
4. 0 & 0.3 (-0.3) means weak correlation.
5. 0.3 & 0.7 (-0.3 and -0.7) means moderate correlation.
6. 0.7 & 1.0 (-0.7 and -1.0) means strongly correlation.

RESULTS:

TABLE 1: IVC diameter in expiration

IVC DIAMETER IN EXPIRATION (mm)	NUMBER OF PATIENTS N=50	PERCENTAGE %
18 – 19	10	20%
17 – <18	30	60%
16 – <17	7	14%
< 16	3	6%
TOTAL	50	100%

Majority of patients (80%) had more than 17 mm IVC diameter in expiration. None of patients had IVC diameter more than 19mm. Mean IVC diameter in expiration was 17.4± 0.04.

TABLE 2: IVC collapsibility index:

IVC COLLAPSIBILITY INDEX [CI]	NUMBER OF PATIENTS n=50	PERCENTAGE%
> 42	5	10%
36 – 42	10	20%

30 – <36	20	40%
< 30	15	30%
TOTAL	50	100%

IVC collapsibility index was less than 36 in 70% of patients

TABLE 3: Incidence of hypotension:

IVC DIAMETER IN EXPIRATION (mean)	NUMBER OF PATIENTS (%)	NUMBER OF INCIDENCE OF HYPOTENSION
18.6	13(26%)	0
17.4	27(54%)	1
16.2	8(16%)	3
15.8	2 (4%)	6
TOTAL	50(100%)	10

Table 4: Correlation of IVC diameter and incidence of hypotension:

IVC DIAMETER IN EXPIRATION (mm)	INCIDENCE OF HYPOTENSION	CORRELATION COEFFICIENT
≥17	1	-0.3
16-<17	3	-0.7
<16	6	-0.9

Patient with IVC diameter more than 17mm, had less incidence of hypotension, while patient had IVC diameter less than 17mm had more incidence of hypotension, it suggests that higher the diameter lesser the incidence of hypotension after spinal anaesthesia.

DISCUSSION:

The inferior vena cava (IVC) is a large, thin walled, high compliance vein. The compressibility index of the inferior vena cava is a function of its distending intraluminal pressure and physical properties of the vessel wall. A better indicator of intravascular volume is collapsibility of the IVC. As intrathoracic pressure decreases with inspiration, venous blood is pulled from the lower half of the body into right atrium. This action causes a transient, but normal, decrease in the IVC diameter. With expiration, the IVC diameter increases and returns to its baseline. These changes are known as respirophasic variability [(4)]. The collapsibility index (reflecting the degree of vessel

collapse during intrathoracic pressure changes of the respiratory cycle) is a useful measure for estimating cardiac preload. The mean IVC diameter in expiration was 17.4± 0.04mm in 80% of patients. In our study, patient with collapsibility index >36% and IVC diameter <17mm in pregnant patients showed more incidence of hypotension. Correlation coefficient was -0.9, which suggest highly correlation. The IVC diameter prove useful in obstetric patients in which rapid confirmation of intravascular volume changes is important for guiding therapy such as obstetric hemorrhage and oliguria [(5)]. Though preoperative volume status, individual differences in vascular elasticity and sympathetic nerve responsiveness may affect the response to volume changes. Nathan et al studied that B -mode, subxyphoid transabdominal long axis 2-3cm caudal to the right atrium junction is the most reliable means of IVC acquisition [(6)], so we used this approach. In recent years, bedside ultrasonography has gained popularity in anesthesiology as being cost effective and a practical diagnostic tool.

CONCLUSION:

Preoperative IVC diameter in expiration is a reliable predictor of hypotension in term pregnant patient after spinal anaesthesia given in caesarean section.

REFERENCES:

1. S. Ceruti, L. Anselmi, B. Minotti, D. franceschini, J. Aguirre, A Borgedt, A Saporito: Prevention of arterial hypotension after spinal anaesthesia using vena cava ultrasound to guide fluid management. British journal of anaesthesia, 25th august 2017 pg no 101-107

2. Celso A Hernandez, Kathryn L. Reed, Elizabeth B Juneman D, Wayne R: Changes in sonographically measured inferior vena caval diameter to fluid loading in term pregnancy. Journal of ultrasound in medicine, January 2016 pg no 2-11.

3. Ayhankaydu and Erhan chokeek: Preoperative and postoperative assessment of ultrasonographic measurements of IVC: A Prospective observational study: Journal of anesthesiology 2018, pg no 146-170.

4. Dipti, A; Soucy, Z; Surana, A.; Chandra, S. Role of inferior vena cava diameter in assessment of volume status: A meta-analysis. Am.J.Emerg.Med.2012, pg no30-35.

5. Seif, D.; Malihot, T.; Perera, P.; Mandavia, D. Caval sonography in shock a noninvasive method for evaluating intravascular volume in critically ill patients: Journal Ultrasound Med 2012; 1885-1890.

6. Nathan M. Finnerty, Ashish R. Panchal, Creagh Boulger, Amra VirAmick: Inferior vena cava measurement with ultrasound: what is the best view and best mode: West JEM.; Apr 2017; 18(3): 496-501.

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