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Original Research Paper

Anesthesiology

A PROSPECTIVE OBSERVATIONAL STUDY TO ASSESS CORRELATION OF CAVAL AORTA INDEX WITH CENTRAL VENOUS PRESSURE FOR INTRAVASCULAR VOLUME ASSESSMENT IN PATIENTS UNDERGOING ENDOSCOPIC TRANSURETHERAL RESECTION OF PROSTATE (TURP)

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ABSTRACT

INTRODUCTION: There are various techniques for assessing the fluid status such as clinical examination, central venous pressure (CVP) measurement, biochemical markers, bio impedance, continuous blood volume measurement, or sonographic inferior vena cava (IVC) diameter assessment. Sonographic evaluation of the IVC and Aorta diameter and its usefulness in evaluating the volume status are studied and documented. The sonographic evaluation of the IVC & Aorta can predict the volume status, this tool can assist anesthetist in rapid diagnosis and prompt resuscitation of patients developing TURP syndrome

AIM OF THE STUDY: The aim & objective of this study is to assess the correlation of Caval Aorta index with CVP in intravascular volume assessment in patients undergoing endoscopic Trans Urethral Resection of Prostate (TURP)

MATERIALS AND METHODS: The study is carried out in the Department of Anaesthesiology involving Department of Urology in Kanyakumari Government Medical College from January 2018 to June 2019. It is a Prospective observational study. To measure the IVC diameter USG machine probe is placed in the sub-xiphoid region to visualize the confluence of the hepatic veins draining the IVC. The maximum internal AP diameter of the Aorta(Ao) and maximum internal anterior-posterior (AP) diameter of the IVC is measured in the longitudinal plane. Fluid status will be measured by CVP and IVC/Ao index recorded before neuraxial block, after preload, at 5 min after intrathecal block, resection time at 0 min, every 15 min during the first 30 min, then every 30 min, until the end of surgery. **Outcome:** Incidence of hypotension after spinal anesthesia in a cesarean section

RESULTS: The mean IVC diameter at pre-operative is 15.20±1.42, and at 60 min, 75 min were 19.39±1.92, 20.03±1.76 which suggests that the size and shape of the inferior vena cava (IVC) is correlated to the CVP and circulating blood volume. In my study the mean Aortic diameter at 60 min, 75 min were 20.30±1.01 and 19.81±1.06 which is same as the preoperative level (19.72±1.18) and diameter. The mean CVP at pre-operative is 4.57±0.73, mean CVP at 60 min, 75 min were 7.57±0.82, 8.11±0.78 which denotes that CVP increases as the intravascular volume status increases. In our study mean IVC/Aortic index at pre-operative is 0.77±0.05 and the mean IVC/Aortic index at 15min, 30 min, 60 min, 75 min were 0.87±0.03, 0.90±0.04, 0.95±0.06, 1.01±0.05 which increases significantly in increasing intravascular volume. The strong correlation between these two variable with Pearson formula ranging from 0.450-0.900.

CONCLUSION: As Sonographic caval Ao index is very well correlated with CVP , IVC/Ao index is useful for the evaluation of preoperative and intraoperative volume status, especially in major surgeries with marked fluid shift or blood loss and had the advantage of being noninvasive, safe, quick, and easy technique with no complications.

KEYWORDS : TURP, IVC diameter, CVP, IVC/Ao Index

INTRODUCTION

Accurate body fluid assessment is always challenging, and estimation of fluid status is needed for guiding fluid therapy for TURP patients. There are various techniques for assessing the fluid status such as clinical examination, central venous pressure (CVP) measurement, biochemical markers, bioimpedance, continuous blood volume measurement, or sonographic inferior vena cava (IVC) diameter assessment. Sonographic evaluation of the IVC and Aorta diameter and its usefulness in evaluating the volume status are studied and documented. Also, ultrasound [USG] imaging has several advantages; it is simple, noninvasive and can be used for repeated assessment. Hence, if this study can establish that sonographic evaluation of the IVC & Aorta can predict the volume status, then this tool can assist anaesthetist in rapid diagnosis and prompt resuscitation of patients developing TURP syndrome.

AIM OF THE STUDY

The aim & objective of this study is to assess the correlation of Caval Aorta index with CVP in intravascular volume assessment in patients undergoing endoscopic Trans Urethral Resection of Prostate (TURP)

MATERIALS AND METHODS

The study was carried out in the Department of Anaesthesiology involving Department of Urology in Kanyakumari Government Medical College from January 2018 to June 2019. It is a Prospective observational study

SELECTION CRITERIA:

Inclusion criteria: Age 50-75 yrs, American Society of Anaesthesiologists Physical Status III or IV, Written informed consent. Exclusion criteria : ASA I & II, Intra-abdominal mass or ascites, Any contraindication to central neuraxial block.patient's refusal to block, bleeding disorders, local infection, Neurological deficits, psychiatric illness

METHODS:

Pre-operative preparation: Baseline Blood pressure, Heart rate, Spo_2 were recorded**.** In the morning of surgery under aseptic precaution central venous catheter (Double-lumen catheter) is inserted into the internal jugular vein with tip of catheter above the junction of superior vena cava and right atrium with the help of USG Machine and the CVP are recorded by Measured using Philips suresign VM8 multipara monitor**.** To measure the IVC diameter, a curvilinear probe of 3.5 MHz of the BPL mindray USG machine is placed in the sub-xiphoid region to visualize the confluence of the hepatic veins draining the IVC. The maximum internal anterior-posterior (AP) diameter of the IVC, 2cm caudal to the confluence of the hepatic veins in the longitudinal plane, is measured on the M-mode. The transverse aortic section in the subxiphoid region is noted lying left lateral to the IVC, and the maximum internal AP diameter of the Aorta(Ao) is measured in the longitudinal plane on the M mode. The IVC/Ao is derived by taking the ratio of the two respective diameters measured. Preloaded with 10 mL/kg ringer lactate solution. Central neuraxial block is

performed aiming block level up to T10. Patients are positioned in lithotomy posture and the TURP surgery is started with warm sterile water as irrigation fluid, keeping the irrigation fluid column at a height of 60 cm, measured from the level of pubic symphysis of the patients on the operating table. Fluid status will be measured by CVP and IVC/Ao index recorded before neuraxial block, after preload, at 5 min after intrathecal block, and immediately after the patients are placed in the lithotomy position. The start of resection is taken as time 0 and measurements are then recorded every 15 min during the first 30 min, then every 30 min, from time 0 until the end of surgery. The two anesthesiologists the one who performing the USG and measures IVC/Ao index, and the other who measures the CVP are blinded to the data obtained by each other. The procedure was terminated when serum sodium level was <125 mEq/L, serum potassium level was >6.0 mEq/L or early signs of restlessness, bradycardia, yawning, etc., have occurred. At least three measurements were obtained to determine the baseline. All patients are carefully observed for the early symptoms of TURP syndrome perioperatively.

OBSERVATION AND RESULTS:

Statistical analysis and interpretations: Based on a similar investigation a sample size of 30 patients was calculated for 90% power, $\alpha = 0.05$, $\beta = 0.1$, and anticipated effect size = 0.40 using sample size software. Descriptive and analytic statistics were performed on IBM compatible computer by using the windows version of SPSS 23 (SPSS Inc) under windows 10 operating system. Data were presented in the form of mean ± standard deviation (SD). Correlation between CVP and IVC/Aorta index using correlation coefficient (Pearson formula).

RESULTS:

The study subjects of 30 patients for thier demographical profiles such as age, weight, height, baseline systolic BP, diastolic BP, heart rate, amount of preload, amount of irrigation fluid, CVP and IVC/Aorta index.

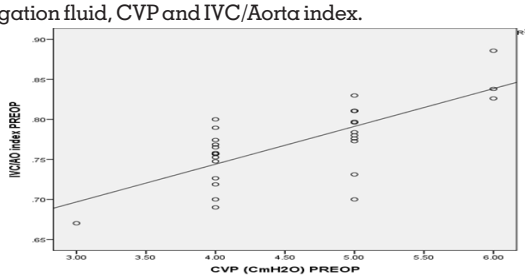

Fig 1:The scattered diagram of the various mean IVC/Ao index against its corresponding CVP values preoperatively:

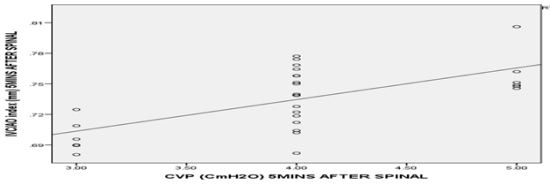

Fig 2:The scattered diagram of the various mean IVC/Ao index against its corresponding CVP values at 5 min after spinal anaesthesia

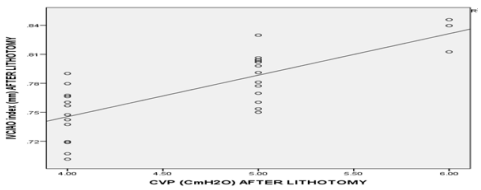

Fig 3 :The scattered diagram of the various mean IVC/Ao index against its corresponding CVP values after lithotomy.

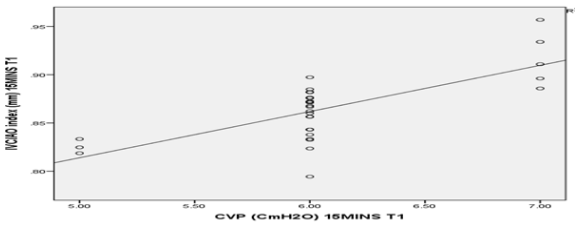

Fig 4:The scattered diagram of the various mean IVC/Ao index against its corresponding CVP values at 15 minutes of resection.

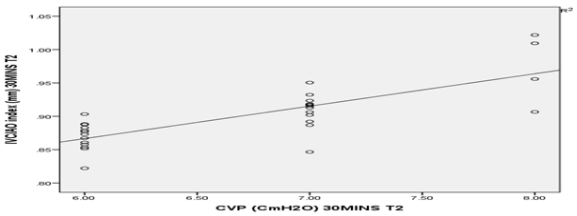

Fig 5:The scattered diagram of the various mean IVC/Ao index against its corresponding CVP values at 30 minutes

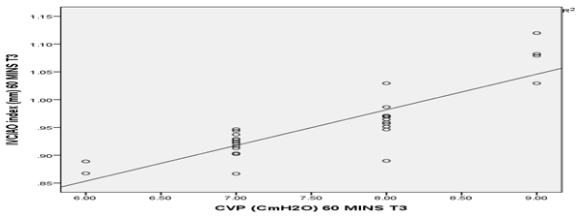

Fig 6:The scattered diagram of the various mean IVC/Ao index against its corresponding CVP values at 60 minutes

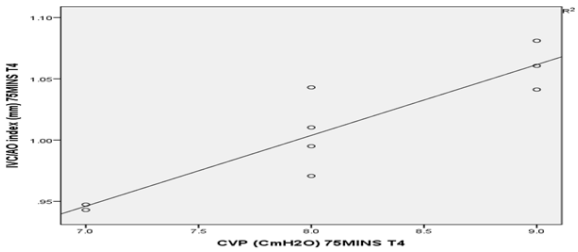

Fig 7:The scattered diagram of the various mean IVC/Ao index against its corresponding CVP values at 75 minutes

DISCUSSION:

All patients were preloaded with 500ml of crystalloids and the average irrigation fluid used is 13 litres. The mean IVC diameter results suggest that the size and shape of the inferior vena cava (IVC) is correlated to the CVP and circulating blood volume, and the IVC is a highly compliant vessel with no valve whose size varies easily with changes of intravascular pressure. Fluid absorption is an inevitable complication of transurethral resection of the prostate (TURP). Central venous pressure (CVP) is a key physiologic estimate of preload, which in turn helps to define the intravascular fluid volume status and guide fluid management. In our study, we have assessed the correlation of IVC/ aorta index and CVP in relation to intravascular volume. In my study all patients were preloaded with 500ml of crystalloids, and average amount of irrigation fluid(ml) used is 13 litres. The mean IVC diameter in my study at pre-operative is 15.20±1.42, and at 60 min, 75 min were 19.39±1.92, 20.03±1.76 which suggests that the size and shape of the inferior vena cava (IVC) is correlated to the CVP and circulating blood volume, and the IVC is a highly compliant vessel with no valve whose size varies easily with changes of intravascular pressure. In my study the mean Aortic diameter at 60 min, 75 min were 20.30±1.01 and 19.81±1.06 which is same as the preoperative level (19.72±1.18) and diameter. The mean CVP in my study at pre-

operative is 4.57±0.73, the mean CVP at after preload is 5.33±0.71, and the mean CVP at 60 min, 75 min were 7.57±0.82, 8.11±0.78 which denotes that CVP increases as the intravascular volume status increases. The result are similar to the various studies conducted for assessing the patient intravascular volume status. In our study mean IVC/Aortic index at pre-operative is 0.77±0.05 and the mean IVC/Aortic index at 15min, 30 min, 60 min, 75 min were 0.87±0.03, 0.90±0.04, 0.95±0.06, 1.01±0.05 which increases significantly in increasing intravascular volume. The IVC/Aortic index appeared to be more sensitive to individual characteristics than was IVCmax diameter, although the R-squared value of the regression analysis of the IVC/Aortic index is only 0.12, compared with the value of 0.08 for the regression analysis of IVCmax and in the IVC/Ao index was more strongly influenced by individual characteristics than was IVCmax in adults. The strong correlation between these two variable with Pearson formula ranging from 0.450-0.900 at different point from preoperative period to resection and at 75 minutes. The sensitivity and specificity of the IVC/Aortic index were calculated to predict the CVP, a CVP ≤7 cm H_2O correlated with IVC/Aortic index of 0.8 ± 0.3 mean ± SD (sensitivity 0.93, specificity 0.66) with PPV = 0.98, a CVP of 8-12 cm H_2O correlated with IVC/Aortic index of 1.5 ± 0.2 mean ± SD (sensitivity 0.96, specificity 0.42) with PPV = 0.9, and a CVP >12 cm H O correlated with IVC/Aortic index of 1.8 ± 0.07 mean ± SD (sensitivity 0.93, specificity 0.58) with PPV = 0.96. In our study at the end of 60 minutes duration after surgery, the CVP range of 1-7 cm and the IVC/Aortic index range of 0.4-1.1 (specificity 1.0) with NPV=0.50%, a CVP range of 8-12 cm and IVC/Aortic index range of 0.9-1.7 (sensitivity 1.0) with NPV=0.75 which is somewhat similar to my parent study, but specificity remain high which is contrast to my parent study and at the end of 75 minutes duration after surgery, the CVP range of 1-7 cm and the IVC/Aortic index range of 0.4-1.1 (sensitivity 1.0) with PPV=0.22%, a CVP range of 8-12 cm and IVC/Aortic index range of 0.9-1.7 (sensitivity 1.0) with PPV=0.77.

CONCLUSION:

As Sonographic caval Ao index is very well correlated with CVP , IVC/Ao index is useful for the evaluation of preoperative and intraoperative volume status, especially in major surgeries with marked fluid shift or blood loss and had the advantage of being noninvasive, safe, quick, and easy technique with no complications.

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