ORIGINAL RESEARCH PAPER

Emergency Medicine

CORRELATION BETWEEN INFERIOR VENA CAVA DIAMETER AND CENTRAL VENOUS PRESSURE DURING RESUSCITATION IN CRITICALLY ILL PATIENTS WITH SHOCK.

KEY WORDS:

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ABSTRACT

Introduction: Shock is one of the most common presentations to emergency departments. Depending on the etiology of shock the management principles vary and using ultrasound in such patients is now widely accepted. Determination of the inferior vena cava diameter can indicate the volume status of the patient and further guide the management of shock in critically ill patients. **Methods:** In this prospective study we identified 50 patients in whom central venous pressure has been correlated with inferior vena cava diameter and their response to fluid resuscitation has been studied. Hypovolemic shock patients were included and other causes of shock were excluded. **Results:** We found statistically significant correlation between inferior vena cava diameter and central venous pressure response to fluid resuscitation with p value of < 0.01. **Conclusion:** Inferior vena cava diameter measurement can be used as a non invasive method to guide in fluid resuscitation in patients with hypovolemic shock.

INTRODUCTION :

Shock is defined as a state of cellular and tissue hypoxia due to either reduced oxygen delivery, increased consumption , inadequate utilization , or a combination of these processes. Shock is often a late manifestation of a disease process. Hypovolaemic shock is a condition provoking a major reduction in blood volume, e.g. internal or external haemorrhage, severe burns, salt and water depletion. There are various techniques for assessing fluid status such as clinical examination, central venous pressure (CVP) measurement, biochemical markers, bioimpedence, continuous blood volume measurement or sonographic inferior vena cava(IVC) diameter assessment. However all of these methods have some limitations when used in clinical practice. Central venous pressure is a useful guide in directing early resuscitative efforts and assists in reducing the morbidity and mortality of ED patients with severe sepsis/septic shock[13,14]. Specifically, in patients with severe sepsis/septic shock, a central venous pressure less than 8 mm Hg is considered an indicator for aggressive intravenous fluid replacement[15]. However as it is a invasive methods it has limitation such as vascular / nerve injuries , pneumothorax , haemothorax or local trauma. Instead, to use bedside ultrasonography as a non-invasive method for hemodynamic monitoring may be a useful tool for emergency clinicians[8] , thereby aiding in fluid management early in the course of resuscitation before more invasive measurements are undertaken[15].

Aims & Objectives :

Aim: To determine the correlation of inferior vena caval diameter and central venous pressure in critically ill patients with shock in need of fluid resuscitation.

Objectives :

1. To measure central venous pressure by invasive central venous line at time intervals of 0, 60mins.
2. To measure inferior vena caval (IVC) diameter by bedside ultrasound at time intervals of 0, 60mins.
3. To assess the response to fluid resuscitation.
4. To correlate between central venous pressure and maximal inferior vena cava diameter at 0 minutes and 60 minutes of resuscitation.

Patients & Methods :

Study was conducted from October 2015 to September 2017. It was a prospective study done on a sample size of 50 patients.

Inclusion Criteria :

1. ALL patients above 18 years and less than 80 years presenting to the emergency with Hypovolemic shock.
2. Patients with systolic blood pressure of less than 90mmHg, diastolic blood pressure of less than 60mmHg and both.
3. Patients with Hypoperfusion with Mean arterial Pressure of less than 60mmHg.

Exclusion Criteria :

1. Patients with PEEP.
2. Pneumothorax or Haemothorax Patients
3. Patients with Portal Hypertension
4. Pregnancy.
5. Intra abdominal compartment syndrome.
6. Morbidly obese patient
7. Patients with cardiac failure and cardiogenic shock.
8. Alcoholic patients with dilated cardiomyopathy.
9. Patients in whom fluid resuscitation is contra indicated.

Treatment and Design :

50 patients fulfilling inclusion criteria were recruited in the study and their blood pressures were recorded before and after 60 minutes of fluid resuscitation. A central venous catheter was inserted to measure the CVP before and after resuscitation. Bedside sonosite ultrasound was used to measure the maximal inferior vena caval diameter at 1-2cms proximal to its opening into the right heart (The measurement was done in M mode at 0minutes and after 60 minutes of fluid resuscitation) and subxiphoid view was used to visualise the inferior vena cava. All patients received 2 boluses of 20ml/kg body weight of Normal Saline during the 60minutes of resuscitation. Statistical analysis was done using SPSS version 19 and T test for independent samples was applied. Regression Coefficient was applied for correlation between Central venous pressure and maximal inferior vena caval diameter.

RESULTS :

Amongst the 50 patients included in the study 50% belonged to age group of 20-40 , 40% belonged to the age group of 41-60 and the rest above 60 years of age. 62% of the patients included were males and 38% were females. The Mean values systolic blood pressures measured at 0min and 60min of resuscitation were 64.46 and 93.32 respectively and were statistically significant with a p value of <0.01. The mean values of diastolic blood pressure at 0 and 60mins of

resuscitation were 37.5 and 63.52 respectively and were also statistically significant.

The mean central venous pressure before resuscitation was 4.28mmHg with a standard deviation of 1.65 and the mean central venous pressure after 60mins of resuscitation was 8.84 with a standard deviation of 1.78. The T test value was 13.28 with a p value of <0.01 and the results were statistically significant. The mean inferior vena caval diameter at 0min of resuscitation was 6.36mm with standard deviation of 1.72 and mean inferior vena cava diameter after 60minutes of resuscitation is 11.44 with standard deviation of 2.43. The test value and p value were 12.06 and <0.01 respectively and the results were found to be statistically significant.

Correlation between central venous pressure and Maximal inferior vena caval diameter at 0minutes of resuscitation and 60minutes of resuscitation was done and the correlation coefficient at 0mins was 0.76 with p value of <0.01 ; the correlation coefficient at 60mins of resuscitation was 0.90 with p value <0.01 showing the results obtained with statistically significant.

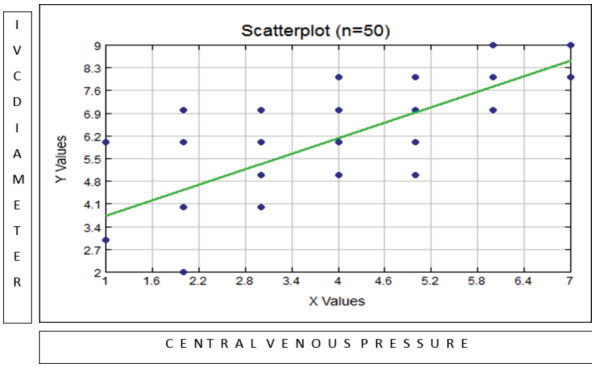

Fig1. Scatter plotting and Regression of correlation between CVP and Maximal IVC diameter at 0 Mins.

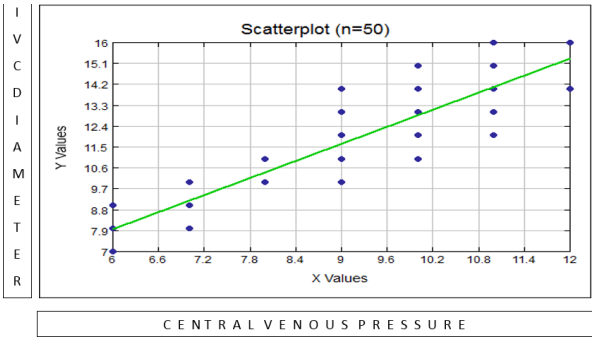

Fig2 : Scatter plotting and Regression of correlation between Central Venous Pressure and Maximal IVC diameter at 60min of resuscitation.

Conclusion and Summary :

Amongst the patients admitted to the emergency department , monitoring central venous pressure might be helpful in the cases of shock , circulatory failure , massive transfusion requirement. CVP is an indicator of intravascular fluid status and the measurement requires invasive central venous catheterisation. The procedure itself carries a 15% risk of early and late complications. There are also associated disadvantages such as prolonged hospitalisation and increase in health care costs. The use of a reliable non – invasive method which correlates with CVP is needed to help avoid such risks associated with invasive procedures.

Among the 50 patients recruited into the study we found that the central venous pressure responds significantly to fluid resuscitation along with the maximal inferior vena caval diameter and there is a statistically significant correlation between the response of CVP and the response of maximal inferior vena caval diameter to fluid resuscitation in hypovolemic shock patients. Using a Non-invasive method such as inferior vena caval diameter in hypovolemic shock patients can be reliable in guiding fluid resuscitation.

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