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A STUDY TO EVALUATE THE CHANGE IN INTERNAL JUGULAR VEIN CROSS SECTIONAL AREA WITH DIFFERENT LEVEL OF POSITIVE END EXPIRATORY PRESSURE

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ABSTRACT
Central venous catheter (CVC) is commonly placed on medical practice for administering drugs and measuring central venous pressure. In the operative setting, right internal jugular vein (RIJV) has become a popular route because of easy access and frequent exclusion from the surgical field. The success rate for CVC placement correlates with the cross-sectional area (CSA) of the vein and several maneuvers such as the Trendelenburg position, Valsalva maneuver, positive airway pressure hepatic compression, humming a tone and carotid palpation had been used to increase the CSA of the vein. In this study we aimed to evaluate the effect of positive end expiratory pressure (PEEP) on CSA of RIJV in adult population and sought to quantify the magnitude of the resultant change.

Key words: Central venous catheter, Right internal jugular vein, Cannulation.

INTRODUCTION

Central venous catheter (CVC) is commonly placed in medical practice for administering drugs and measuring central venous pressure. In the operative setting, right internal jugular vein (RIJV) has become a popular route because of easy access and frequent exclusion from the surgical field [1]. The incidence of mechanical complications can be as high as 19% and is related to the number of needle passes. The most common mechanical complication of internal jugular vein (IJV) cannulation is carotid artery puncture, which infrequently is a serious complication, but is best avoided. Various dynamic maneuvers increase RIJV size and may increase the speed and safety of cannulation by decreasing the number of needle passes [2-7]. The success rate for CVC placement correlates with the cross-sectional area (CSA) of the vein and several maneuvers such as the Trendelenburg position, Valsalva maneuver, positive airway pressure hepatic compression, humming a tone and carotid palpation had been used to increase the CSA of the vein [8-15]. In this study we evaluated the effect of positive end expiratory pressure (PEEP) on CSA of RIJV in adult population and sought to quantify the magnitude of the resultant change. To evaluate the effect of PEEP on CSA of the RIJV to quantify the magnitude of the resultant change.

METHODS AND MATERIALS

This study was conducted in the operation theatres of Dayanand Medical College and Hospital, Ludhiana after getting approval from hospital's ethics committee. Confidentiality and data protection was adhered to as maximum standards. After obtaining written informed consent from the patients, 40 ASA physical status I and II patients undergoing elective surgery under general anaesthesia will be enrolled for the study. Patients served as their own controls for comparison. Standard induction of general anesthesia with propofol 2 to 3 mg/kg IV, fentanyl 0.5 to 1 μg/kg IV, and rocuronium 1 mg/kg IV was done to facilitate endotracheal intubation and were

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subsequently mechanically ventilated using volume-control mode with tidal volume 6 to 8 mL/kg, respiratory rate 10 to 12 breaths per minute, inspiratory to expiratory ratio 1:2, PEEP 0 cm H_2O (P0), and maintained with isoflurane in a mixture of nitrous oxide and oxygen.

The operating table was placed in a level position in the transverse and longitudinal planes and the patient positioned with 30° of left head rotation. Five minutes after initiation of mechanical ventilation the RIJV CSA at the level of the cricoid cartilage was calculated using B-mode duplex sonography with a 5- to 13-MHz linear transducer (SONOSITE) using a standardized technique applying minimal probe pressure to obtain an adequate sonographic image. PEEP level 10 cm H_2O was then be applied and, after 2 minutes of instituting the PEEP, the same investigator subsequently obtain sonographic image of the RIJV at the same location on the neck and calculate CSA. Patients with a history of haematological disease, external neck injury, previous RIJV catheterisation, severe cardiovascular disease, RIJV thrombosis, injection-site infection, pneumothorax or pulmonary bulla will be excluded.

RESULTS

Enrolled patients varied in age from 18 to 70 years, with a mean ±SD age of 50.85±11.59 years. The study included 15men and 25 women. Patient demographics are included in Table 1.

Table 1. Patient demographics

	All Patients	Men	Women
Age	50.85±11.59	50.4±11.62	49.28±10.68

IJVs were easily visualized with ultrasound in all patients. The mean ± SD change in CSA of the RIJV with application of PEEP 10 cm H2O was 1.71±0.31cm2 which was an absolute increase of 0.26±0.25 (P <0.05). The values are included in Table 2

Table 2.

	CSA
PEEP 0	1.45±0.26
PEEP 10	1.71±0.31
Absolute Change	0.26±0.25*
Relative Change (%)	

CSA _ cross-sectional area (cm2); Values are mean _ SD (median). * P _ 0.05

DISCUSSION

Trendelenburg position and Valsalva maneuver are the most common clinical techniques used to increase the IJV CSA for increasing the of CVC cannulation and decrease the associated complications. A number of ultrasound studies have been conducted to determine the CSA of the right internal jugular vein in response to various maneuvers, such as the Trendelenburg and reverse Trendelenburg tilt position with different tilt degrees, Valsalva maneuver, hepatic compression, humming a tone, carotid palpation, needle advancement, and several combinations of maneuvers.

Our study shows that application of PEEP as the sole maneuver increases the size of the RIJV. The extent of increase in CSA is similar to other frequently used techniques in the majority of patients. The CSA area increased by 19 percent on application of 10 cm of PEEP with mean CSA area increasing to 1.71 cm^2 from 1.45 cm^2 when no PEEP was applied. Trautner et al demonstrated in pediatric patients that Trendelenburg position and addition of PEEP (0, 5, and 10 cm H2O) increased IJV size directly with increasing age [15].

The potential drawbacks to the use of PEEP include patient comorbidities that may be worsened by its use, such as increased intracranial pressure, poor cardiac function, or significant intravascular volume depletion. This method may not be suitable for theses subgroup of patients. Hence in ASA grade I and II patients, application of a PEEP of 10 cms of H_2O can help in better localization of the RIJV, as well as may be useful in its cannulation by increasing the CSA.

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CONFLICT OF INTEREST

No interest

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