Point of care ultrasound (POCUS) for appropriate head flexion during patient positioning: Role of internal jugular vein outflow grading

Appropriate patient positioning is required to facilitate neurosurgical procedures done in the occipital lobe, posterior fossa, cranio-cervical junction tumours and spine. Excessive neck flexion is avoided to prevent cervical cord ischaemia and any reduction in cerebral venous drainage due to obliteration of internal jugular vein (IJV). Hence, the distance between chin and sternum has been recommended to maintain at least 2 to 3 finger breaths.[1] Also, the head shouldn't be turned more than 30 degrees to one side, especially towards the dominant jugular vein.[1]

In the supine or prone position, IJV is the primary outflow route from the cranial cavity. In contrast, it tends to collapse in upright position wherein the vertebral venous plexus becomes the important outflow tract.[2,3] The blood flow in the IJV is dynamic and is influenced by various factors like posture, anatomical variations, incompetence of the jugular valve, and changes in central venous or intrathoracic pressure. Assessing the blood velocity at a single time point will not be a true reflection of blood flow status. Instead, we can use doppler ultrasound to study the direction and pattern of blood flow in the IJV to aid in the diagnosis of venous outflow obstruction.

Here, we describe four different venous blood flow pattern in the IJV with different degrees of head flexion

in a prone patient under general anaesthesia. A linear array probe (5-12 MHz) was kept in the sagittal plane with the sampling window spanning the width of the IJV. After this IJV, blood flow waveform was captured using doppler ultrasonography. The doppler spectra was acquired for a period of 5 second, and in triplicate. The flow below the baseline (0 cm/s) signifies normal flow in the head-to-heart direction, whereas flow above the baseline signifies reverse flow towards the head.[3] Therefore, we used 1 to 4 venous flow grading system for the detection of IJV venous outflow obstruction during patient head positioning [Figure 1]. This venous blood flow grading is based on the direction doppler signal. Grade 1: predominantly continuous forward flow (head to heart), Grade 2: nominal forward flow with pulsatility, Grade 3: stagnant flow (equal positive and negative flow), and Grade 4: reverse blood flow (heart to head). In our case, we observed venous blood flow pattern, Grade 1 at neutral head position, Grade 2 at head flexion with 4 finger gap between chin and sternum, Grade 3 at 3 finger gap between chin and sternum and grade 4 when head flexion beyond the 3 finger gap. Written and informed consent for publication was taken from the patient.

Hence, according to us, real time monitoring of venous flow pattern of IJV is a more reliable indicator of optimal neck flexion without compromising the venous return and intracranial tension. This could be an alternative to using an arbitrary 2 or 3 finger gap between chin and sternum. We recommend maximal allowable head flexion up-to the grade 2 venous flow pattern. Further studied required to validate our findings.

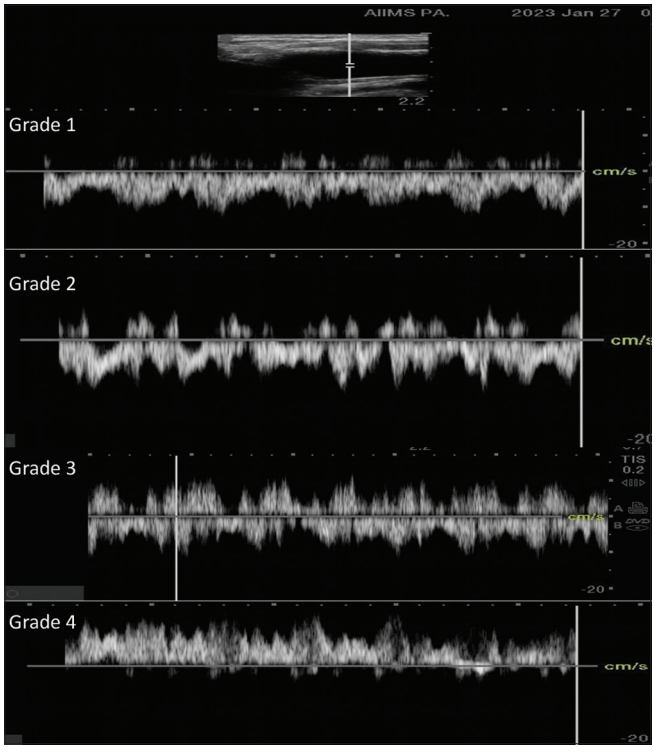

Figure 1: Internal jugular venous blood flow pattern change with increase in head flexion

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Conflicts of interest

There are no conflicts of interest.

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