How to assess contraction of the cervical deep muscle extensors using real-time ultrasound

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Background: Deep cervical extensor (DCE) muscles become impaired in cervical spine disorders and lead to key functional restrictions (eg inability to hold the head up). Whilst there are several methods to evaluate the impairment of the DCE's, real time ultrasound (RTUS) is less invasive, less expensive and more clinically accessible, allowing for observation of the contraction of the DCE's in real time. Our work recently demonstrated the reliability of a clinical protocol, whereby impairment of the DCE is evaluated by observing the change in the muscle dimensions under load using video RTUS.

Aims / objectives: Participants will understand the role of the DCE's and how they become impaired in cervical spine disorders. Participants will have the clinical skills to assess the contraction of the DCE's using video RTUS as well as understanding how to interpret this information in context of a comprehensive cervical spine assessment.

Approach: A 10 minute presentation on the background research will be followed by a demonstration of the assessment protocol using video RTUS. Participants will then have the opportunity to practice. An interactive discussion will follow on how to interpret and integrate this information into clinical practise. Hand-outs on the assessment protocol will be provided.

Conclusion / Key Practice Points:

- Participants will have an additional clinical skill in the assessment of DCE's
- They will understand how to incorporate this into the routine assessment of cervical spine disorders
- Clinical reasoning on how to interpret and use RTUS in rehabilitation of the cervical extensors will enhance clinical practise

PROTOCOL FOR MEASUREMENT OF DEEP CERVICAL EXTENSORS USING REAL TIME ULTRASOUND

Configuration of the ultrasound machine

For the measurement of cervical multifidus, a 5-10MHz transducer (adjusted to 5MHz for big build, 7.5 MHz for medium build, and 10MHz for small build) transducer is used to make measurements of muscle size and shape (VF 8- 3 +); depth is set at 4cm (may need to adjust for a larger neck size i.e. 5 cm) and focus adjusted to the level of the midpoint of the muscle. Gain, dynamic range, TGC and contrast is adjusted to optimise visualisation of the fascial planes.

Identification of the deep cervical extensors (DCE)

The spinous process of the desired level is identified by palpation and marked with a pen.

Imaging of the neck

Imaging of the neck is carried out by placing the transducer perpendicular to the long axis of the posterior neck at the spinous process of interest. The left and right side of the neck is imaged separately by sliding the transducer left/right until an image is obtained where the spinous process is horizontally level with the uppermost part of the articular pillar.

The deep cervical extensors (multifidus and semispinalis) are identified by the following landmarks: inferiorly the bony outline of the lamina, laterally by the facet joint, superiorly by the fascial plane, medially by the spinous process. The clearest image is ensured by maintaining the transducer 90 degrees to the fascia of the underlying muscle or varying the tilt of the transducer until the clearest fascial plane is present.

Procedure

A standardised position of the participant is to be ensured for reproducibility of measurements across participants. The participant is seated in a chair with feet flat on the floor facing the bed. The participant's head is rested on pillows. Once the image is obtained, begin video recording then move the transducer laterally left/right until an image is obtained where the spinous process is parallel with the uppermost part of the articular pillar. This method allows for horizontal alignment of bony landmarks. Once in this position, vary the tilt of the transducer until the clearest delineation of the fascial planes is observed. Ask the participant to performed a sub-maximal contraction (unweight head), then stop the video and ensure the clip is digitally recorded.

Measurements

Width (Horizontal line: Figure 1)

The width of the DCE's is measured as the distance between the echogenic spinous process/highest point of the spinous process and the point where the two fascial planes meet adjacent to the supero/medial border of the facet.

Thickness (Vertical line: Figure 1)

The thickness of the DCE's is measured by bisecting the lateral distance, measuring from leading edge to leading edge-top edge of fascial plane superiorly, to the top edge of the lamina (brightest part).

Contraction (change in thickness or width)

The muscle contraction is measured ad the change in thickness or width. Simply subtract the measure obtained at rest from the measure obtained when contracted.

Example data

Example data will be given in the HOW to session and in the e-poster prepared by Veronica Desa.

FIGURE 1: Measurement of the DCE's using onscreen callipers