Relationship between cervical muscle morphology evaluated by MRI, cervical muscle strength and functional outcomes in patients with degenerative cervical myelopathy.

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Reduced cervical muscle strength has been reported in patients with whiplash-associated disorders (WAD) or insidious onset neck pain.1,2 However the relationship between cervical muscle size and strength deserve further attention in patients with neck pain, specifically in patients with degenerative cervical myelopathy (DCM). Although, some evidence suggests a positive correlation between muscle CSA and muscle strength,3,4 others found no such correlation.4 The relationship between muscle size and muscle strength may not have the same clinical applicability in DCM, as patients with myopathy likely have alterations in the morphology of the cervical contractive and noncontractive tissues.4

Our previous study on paraspinal morphology was the first to establish an association between cervical muscle morphology with clinical symptoms and functional status of patients with DCM.5 However, the relationship between cervical muscle morphology, muscle strength, clinical symptom and functional status warrants further investigation to confirm the clinical relevance of cervical muscle morphology parameters (observed on MRI) and their effect on muscle function (e.g. strength). As physiotherapy and rehabilitation have a strong implication in the management of this condition, a better understanding of the characteristics and implications of cervical muscle morphology in DCM may provide valuable insight for more effective and targeted rehabilitation.

Methods and Materials

Cervical muscle measurements of total cross-sectional area (CSA), functional CSA (fat free area, FCSA) and ratio of FCSA/CSA (e.g. fatty infiltration) were obtained from T2-weighted axial MR images from C2-C3 to C6-C7 in 20 patients. Muscle strength was assessed using a micro ETF2 dynamometer.

Greater mean CSA and FCSA was associated with greater overall muscle strength. The mean ratio of FCSA/CSA (e.g. fatty infiltration) was associated with stronger muscle strength in all directions, as well as greater overall muscle strength. Again, age and BMI were significant covariates and entered in the multivariate analyses. The mean FCSA explained 37%, 76%, 30% and 65% of the total variance in flexion, extension, right side-bending, left side-bending and overall muscle strength, respectively.

While the mean ratio of FCSA/CSA (e.g. degree of fatty infiltration) was not significantly associated with cervical muscle strength in any direction. None of the MRI muscle parameters were significantly associated with symptoms severity or functional status, with the exception of greater mean FCSA/CSA (less fatty infiltration) which was associated with higher mOAB score (lower disability) (p=0.02, R²=0.20).

Conclusions

Future studies should further evaluate the specific rehabilitative strengthening cervical muscle exercises on CSA and FCSA in patients with DCM. It would also be valuable to investigate whether changes in CSA or FCSA and muscle strength contribute to variations in patient symptoms, functional outcomes, and prognosis following surgery.

References

None of the authors has any potential conflict of interest.