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# Shoulder Pain and Regional Interdependence: Contributions of the Cervicothoracic Spine

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Shoulder pain is common, with a reported prevalence between 20-33% [1]. Additionally, the incidence of shoulder pain in the general population appears to be increasing [2]. The prognosis for patients with a new onset of shoulder pain is generally poor, with recovery rates of only 49-59% at an 18-month follow-up [3,4]. Recurrence rates are also high, as Rekola et al. [5] reported that 1 in 4 individuals with shoulder or neck pain will experience at least one episode of recurrence within 12 months of onset. In the year 2000, the direct costs for the treatment of shoulder pain in the United States topped $7 billion, [6] and Kuijpers et al. [7] reported that 74% of the total costs for managing shoulder pain are attributable to individuals with persistent or recurrent symptoms. Shoulder pain can be challenging for both patients and health care providers. A study by Ostor et al. [8] on non-specific shoulder pain reported that 77% were diagnosed with more than one shoulder problem. Many shoulder pathologies present with similar examination findings, but vary widely in their outcomes and require different intervention approaches [9]. Specific diagnosis and classification can be difficult, as de Winter et al. [10] reported only moderate agreement on the classification of shoulder disorders. Given that shoulder pain is difficult to accurately diagnose, Dinant et al. [11] argue that we need a shift from diagnostic to prognostic research.

Regional interdependence has been defined by Wainner et al. [12] as "the concept that seemingly unrelated impairments in a remote anatomical region may contribute to, or be associated with, the patient's primary complaint." Up to 40% of patients with shoulder pain present with dysfunction in the cervicothoracic spine and ribs, [13-18] and Sobel et al. [16] concluded that dysfunction in these regions may represent an intrinsic cause of shoulder pain. Norlander et al. [13-15] reported a significant correlation between thoracic spine hypomobility and the presence of neck-shoulder pain. Impairments of the cervicothoracic spine and ribs triple the risk of developing neck and shoulder disorders and may worsen prognosis [13-16,19].

Current evidence suggests that the inclusion of manual therapy interventions improves outcomes in the treatment of individuals with shoulder pain [20-28]. Several studies have reported improved outcomes in patients with shoulder pain following manual therapy directed solely at the cervicothoracic spine [19, 21, 24, 26]. These findings suggest that a subgroup of individuals with shoulder pain may exist who will respond dramatically to this regional interdependence approach. In 2010 we reported a set of prognostic variables that identified patients with shoulder pain likely to benefit from manual therapy to the cervicothoracic spine [24]. We conducted a prospective, cohort study of 80 consecutive patients with non-specific shoulder pain. Subjects completed a series of self-report measures and received a detailed standardized history and physical examination consisting of a variety of tests and measures commonly used to classify individuals with shoulder pain. All subjects received a standardized treatment regimen consisting of cervicothoracic spine manual therapy, 2 general cervical mobility exercises, and advice to maintain usual activity within the limits of pain. Subjects were classified as having experienced a successful outcome based on a well-accepted reference standard of success, the patient-reported Global Rating of Change [27-29]. Sensitivity, specificity, and positive and negative likelihood ratios were calculated for all potential predictor variables. Univariate techniques and step-wise logistic regression were used to determine the most parsimonious set of variables for prediction of treatment success. Variables retained in the regression model were used to develop a multivariate set of prognostic variables to identify patients with shoulder pain likely to benefit from manual therapy to the cervicothoracic spine. Eighty patients were included in the data analysis, of which 49 had a successful outcome (61%). Five prognostic variables were identified:

1. Pain free active shoulder flexion < 127 degrees
2. Shoulder internal rotation < 53 degrees
3. A negative Neer test
4. Patient not taking medications of any kind for their shoulder pain
5. Duration of symptoms less than 90 days

If 3 of 5 variables were present (positive LR=5.3, 95% CI=1.7-16.0) the likelihood of success increased to 89%. All individuals that presented with 4 or 5 of the variables had a positive outcome (+LR ∞, post-test probability 100%). As this was a preliminary study without a control group, caution must be applied in interpreting these prognostic variables as they may simply identify patients who would improve with time regardless of intervention, or they may be statistical quirks. To investigate the validity of our findings, we have just completed a follow-up randomized controlled trial in which patients were randomly assigned to receive either a comprehensive shoulder exercise program alone or the same exercise program combined with cervicothoracic spine manual therapy. If the prognostic variables we identified are indeed valid, patients who present with the prognostic factors and receive cervicothoracic spine manipulation should experience improved outcomes compared to patients who do not present with these factors. We are in the process of analyzing the data, and results should be published soon.

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