Neurosurgical Forum

LETTERS TO THE EDITOR

Lumbar muscle strength changes after fusion: only due to rehabilitation exercises?

TO THE EDITOR: We read with interest the article by Lee et al.⁶ (Lee CS, Kang KC, Chung SS, et al: How does back muscle strength change after posterior lumbar interbody fusion? *J Neurosurg Spine* 26:163–170, February 2017). We note the increase in muscle strength and superior clinical outcomes in patients who were prescribed lumbar strengthening exercises after posterior lumbar interbody fusion compared with those who were not.

Notably, a rigid thoracolumbar orthosis was worn by all patients in the study for the first 3 months postoperatively and the atrophic muscular effects of this are evident (7.5% decrease in muscle strength). Choi et al. evaluated patients after discectomy for lumbar extensor power and size,² demonstrating that a postoperative early lumbar extension muscle-strengthening program had positive effects on pain, return to work, and strength of back muscles.

The difference between the two groups may also be explained by other factors. The control group opted out of the rehabilitation program. They may have had a lack of motivation to undergo rehabilitation. They may have had greater pain scores postoperatively as reflected by the visual analog scale (VAS) scores at 3 months (43.2 vs 36.7) despite similar postoperative treatment up to that point. While insignificant in isolation, collectively the control group displayed characteristics consistent with a poorer outcome as they were older (59 vs 55 years), leaner (58 vs 54 kg), had poorer bone mineral density (T-score 1.7 vs -1.2) and had a greater number of levels fused (24 vs 19 had 2-level fusions). The control group may have felt apprehensive about or inhibited from undergoing exercises. The effects of closer follow up for those who underwent the rehabilitation program may have meant that the rehabilitation patients received, or at least believed that they received, superior care, as previously reflected by Christensen et al.³ Finally, the rehabilitation group would have been preconditioned to the lumbar strength tests through patient education and may have performed better.

Multifidus muscle assessment has been shown to be an excellent method of objective rehabilitation analysis by this author and others.^{1,4,5} Assessment measures include ultrasonic muscle cross-sectional area analysis and needle electromyography. Ultrasonography has been previously

validated, is very reproducible, and takes up little time. The image is taken in the transverse plane, as approached from the posterior aspect, with the patient prone, and multifidus muscle is identified on either side of the posterior spinous process. Needle electromyography, while valid, is not as well tolerated by the patient but may be useful in patients in whom additional understanding is needed if the rehabilitation is not progressing as planned. The spectrum of muscle changes range from normal, to high-amplitude wide complex units adjacent to a normal unit, to ongoing prominent fibrillations, to widespread fibrillation potentials with variable re-innervation.

Differences between patients who do or do not undergo postoperative rehabilitation as shown in this paper are not so much a weakness of this paper but are reflective of why these differences exist. Differentiating between the subjective and objective outcomes of spine surgery and the contribution of muscular (dys)function may help our understanding of treatment effects in these patients.

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Disclosures

The author reports no conflict of interest.

Response

We would like to thank Dr. Cawley for his interest in our article and his meaningful comments. We partially agree with the points that he has raised. This different viewpoint is needed for ensuring the objectivity of our study to the readers. To our knowledge, there are no studies that have shown detailed postoperative changes in back strength and exercise effects after lumbar fusion operations. The qualification of our study is positively necessary. This is our reply to the letter from Dr. Cawley.

First, the differences in demographic data (such as VAS pain score, age, weight, bone quality, and number of levels fused) between the 2 groups were pointed out, but there were no statistically significant differences. Even if there were some differences for these items between the 2 groups, we cannot consider that these minute differences significantly influenced the results of our study.

Second, the exercise group might feel that they received superior care and might be preconditioned to the strength test.² This situation could explain the better results of the strength test in the exercise group, but would not account for the better clinical outcomes that were measured using various clinical assessment tools. The exercise group showed better outcomes for pain and functional scores. Familiarity with strength tests cannot guarantee better clinical outcomes in clinical fields. In addition, all patients were thoroughly instructed in the method for accurate testing and performed warm-up exercises for 15 minutes before the test. In addition, during the tests, visual feedback was provided on a video display screen interfaced with the machine, and the patients were also verbally encouraged to give their maximum effort by the same specialized physical therapist. This systemic methodology of the strength test may have reduced measurement errors for the tests.

Finally, we agree that multifidus muscle assessment is considered as one of the most important analyses for rehabilitation effects. In particular, the noninvasive ultrasound muscle quantification is quite impressive.¹ However, this ultrasound measurement is not currently popular and postoperative precise quantification of paravertebral muscles around the implants cannot be guaranteed; and other

studies do not analyze patients after spinal operations.^{3,4} We also consider that electromyographic studies using needles are not good for postoperative analysis in patients with spinal implants, due to this method's invasiveness.

Once more, we thank Dr. Cawley for his comments. We are open to the possibility that he has pointed out reasons for better results of the strength tests in the exercise group. However, the strength tests were performed systematically by the one specialized therapist, and besides results of the tests, clinical assessments that have been measured with various tools have shown better results until 12 months postoperatively. We believe that other methodological problems that have been brought up are not significant enough to change our results.

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