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The Use of a Lumbar Spine Manipulation Technique by Physical Therapists in Patients Who Satisfy a Clinical Prediction Rule: A Case Series

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Study Design: A case series of patients with low back pain (LBP) who satisfy a clinical prediction rule (CPR).

Background: A CPR that identifies patients with LBP who are likely to respond with rapid and prolonged reductions in pain and disability following spinal manipulation was developed and recently validated. The CPR developed to predict favorable response to manipulation investigated the effects of only 1 manipulation technique. The accuracy of the CPR for predicting outcomes using other manipulation techniques is not known. The purpose of the case series was to describe the outcomes of patients presenting to physical therapy with LBP who met the CPR and were treated with an alternative lumbar manipulation technique.

Case Description: Consecutive patients referred to physical therapy who satisfied the eligibility criteria, including the presence of at least 4 of the 5 criteria on the CPR, were invited to participate in the case series. Patients were treated for 2 visits with a side-lying lumbar manipulation technique, followed by a basic range of motion exercise. Patients who exhibited a 50% reduction or greater in disability, as measured by the Oswestry Disability Index (ODI), were considered to have experienced a successful outcome.

Outcomes: A total of 12 patients participated in the case series. The mean age of the group was 39 years (SD, 8.9 years) and the median duration of symptoms was 19 days (range, 8-148 days). Of the 12 patients who participated in this case series, the mean reduction in disability as measured with the ODI was 57% (SD, 9%). Only 1 patient did not surpass the 50% reduction in ODI scores.

Discussion: Eleven of the 12 patients (92%) in this case series who satisfied the CPR and were treated with an alternative lumbar manipulation technique demonstrated a successful outcome in 2 visits. It is plausible that patients with LBP who satisfy the CPR may obtain a successful outcome with either manipulation technique directed at the lumbopelvic region. *J Orthop Sports Phys Ther 2006;36:209-214.*

Key Words: *low back pain, manual therapy, physical therapy*

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This case series received approval from the Institutional Review Board at Concord Hospital, Concord, NH. The opinions or assertions contained herein are the private views of the authors and are not to be construed as official or as reflecting the views of the US Air Force or Department of Defense.
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CASE REPORT

Low back pain (LBP) results in prolonged disability and substantial economic burden that exceeds nearly $50 billion annually in the United States alone.[12,25] The health care and disability costs for patients with LBP is comparable to that of depression, heart disease, and diabetes.[6] It has been reported that 37% of the health care costs associated with LBP are a direct result of physical therapy services.[21]

An intervention commonly used by physical therapists in the treatment of individuals with LBP is spinal manipulation. The Guide to Physical Therapist Practice[1] identifies mobilization/manipulation as

TABLE 1. The 5 criteria in the clinical prediction rule developed by Flynn et al.[8]

Criteria	Definition of Positive
Symptom location	No symptoms distal to knee
Duration of current episode	Less than 16 d
FABQ work subscale	Less than 19
Segmental mobility testing in a postero-anterior direction	At least 1 hypomobile segment in the lumbar spine
Hip internal rotation range of motion	At least 1 hip with greater than 35° of internal rotation

Abbreviation: FABQ, Fear-Avoidance Beliefs Questionnaire.

an intervention appropriate for the care of patients with spinal disorders. Recently, a clinical prediction rule (CPR) has been derived[8] and validated[3] that accurately identifies patients with LBP who are likely to respond with rapid, and prolonged reductions in pain and disability following spinal manipulation. In both studies[3,8] a favorable response to a lumbopelvic manipulation was defined as a 50% or greater reduction in self-reported disability occurring over 2 treatment sessions. In the studies by Flynn et al[8] and Childs et al,[3] over 90% of patients with LBP who satisfied 4 of the 5 criteria in the CPR (Table 1) experienced a successful outcome within 1 week.

The CPR developed to predict a favorable response to manipulation investigated only a single manipulation technique (Figure 1).[8] This particular manipulation technique generally targets the lumbopelvic spine as the therapist applies high-velocity thrust through the patient's anterior superior iliac spine. The accuracy of the CPR for predicting the outcomes using other manipulation techniques is not known. Traditionally, clinical decision making regarding the use of manual therapy techniques has been based on biomechanical principles and the assumptions that specific techniques are required to achieve optimal outcomes.[16,20] Most manual therapy approaches advocate that a specific manual-therapy technique should be selected based on findings from intersegmental mobility assessment and that localization of the technique to a specific spinal level is pivotal to achieve a positive response to treatment.

Recent literature provides evidence that makes the validity of this assumption questionable. For example, Chiradejnant et al[4] examined 140 patients with LBP and found no difference in outcomes between patients who received the mobilization technique selected by the treating therapist or a randomly selected technique. In addition, other studies[2,22] have noted that manipulation techniques are not specific to the target segment and often affect numerous segments, suggesting that spinal manipulation may lack spatial specificity.

The ultimate criterion for judging the usefulness of treatment is determining its impact on patient outcomes.[23] It would be helpful for clinicians and researchers to understand whether an alternative manipulation technique among patients who meet the CPR results in similar or different outcomes. If different manual therapy techniques result in similar patient outcomes, this may challenge many of customary manual therapy philosophies that suggest that clinical decision making based on biomechanical constructs is necessary to select a specific technique to reduce disability and obtain a successful outcome.

Therefore, the purpose of the case series was to conduct a preliminary investigation of this idea and describe the outcomes of patients presenting to physical therapy with LBP who met the CPR criteria, but were treated with an alternative lumbar manipulation technique.

CASE DESCRIPTION

Consecutive patients, referred by their primary care physician to 1 physical therapist at the Rehabilitation Services of Concord Hospital, were examined for eligibility. Inclusion criteria included the presence of LBP, an Oswestry Disability Index (ODI) score of equal to or greater than 30%, and positive findings for at least 4 of the 5 criteria on the CPR (Table 1). In addition, patients needed to be able to read and understand English to complete the outcome questionnaires. Exclusion criteria included the presence of any signs or symptoms of medical red flags (ie, tumor, fracture, metabolic diseases, rheumatoid arthritis, osteoporosis, prolonged history of steroid use, etc), bilateral lower extremity symptoms, evidence of central nervous system involvement (eg, positive Babinski sign), positive neurologic signs or symptoms suggestive of nerve root involvement (diminished sensation, lower extremity reflexes, or sensation to

FIGURE 1. Supine manipulation technique used in the development and validation of the clinical prediction rule. Photo used with permission of Icon Learning Systems.

sharp and dull, or strength deficits of muscles in a myotome), current pregnancy, and prior surgery to the lumbar spine. The Institutional Review Board at Concord Hospital, Concord, NH, approved this case series and all patients provided informed consent.

Examination

Patients completed a variety of self-report measures, followed by a standardized history and physical examination performed by a physical therapist. Self-report measures included a body diagram to assess the distribution of symptoms, modified ODI, and Fear-Avoidance Beliefs Questionnaire (FABQ). The FABQ was used to quantify the patient's fear of pain and beliefs about avoiding activity.[24] Previous studies have found high level of test-retest reliability for both the Physical Activity (FABQPA) and Work (FABQW) subscales.[15] Fear-avoidance beliefs have been associated with current and future disability and work loss in patients with acute[10] and chronic[5] LBP. A FABQW subscale less than 19 points is one of the criteria in the CPR (Table 1). In addition, patients recorded the location of their symptoms on the body diagram. The body diagram was used to determine if the patient met the CPR criterion related to not having symptoms distal to the knee.

The modified ODI was used to measure disability and consists of 10 questions.[11] Each question is scored from 0 to 5, with higher scores indicating greater disability. The scores were then converted to a percentage score. The test-retest reliability of the modified ODI has been shown to be high (ICC = 0.90).[11] We used the ODI as our primary outcome measure and, similar to previous studies,[3,8] a 50% reduction in the ODI served as the reference standard to determine whether a successful outcome was achieved.

The history consisted of demographic information including age, sex, past medical history, location and nature of symptoms, relieving/aggravating activities, prior episodes, occupation and leisure activities, and onset date of most recent episode. The date of onset was used to determine if the patient met the CPR criterion of less than 16 days duration. The physical examination included measurements of active lumbar range of motion and passive postero-anterior mobility of the lumbar spine using the spring test.[19,20] Lumbar spine segments were graded as ''normal,'' ''hypomobile,'' or ''hypermobile,'' and the provocation of pain with spring testing was noted. In addition, the therapist performed myotomal testing, sensory examination to sharp and dull, muscle stretch reflex testing, the straight-leg-raise test, and measurements of passive internal and external rotation range of motion of the hips in prone. This procedure has been shown to exhibit excellent inter-rater reliability (ICC, 0.95-0.97).[7]

FIGURE 2. Alternate side-lying lumbar spine manipulation technique used in this case series.

Intervention

Patients enrolled in the case series were treated on both the first and second visit with a different manipulation technique than that used to develop and validate the CPR. Patients also completed a basic range-of-motion exercise. The alternative manipulation technique was performed with the patient side lying. The therapist stood in front of the patient. The therapist then flexed the patient's top leg until there was movement detected at the selected segmental interspinous space and placed the patient's foot in the popliteal fossa of the bottom leg. Next, the therapist grasped the patient's bottom shoulder and arm and introduced trunk side bending towards the table and contralateral rotation until motion was again felt at the specified interspinous space. The patient's positional setup was maintained, while the patient was rolled toward the therapist. Finally, the therapist's arm and body were used to apply a high-velocity, low-amplitude thrust of the pelvis in an anterior direction (Figure 2).

The patient was first treated with the more symptomatic side up (lying on his/her less symptomatic side), based on the patient's self-report. If the patient could not identify a more symptomatic side, the therapist arbitrarily selected a side to manipulate first. To standardize the intervention, the therapist targeted the manipulation to the L4-L5 segment in all patients. This was done because recent research suggests that greater benefits result from manual therapy techniques directed towards the lower lumbar spine.[4] Although we recognize that recent evidence suggests that the effects of manipulative techniques are likely not level specific.[22]

The physical therapist used a similar algorithm to that followed in the Flynn et al[8] and Childs et al[3] studies to determine the number of manipulation techniques performed during each treatment session. After the first manipulation was performed, the physical therapist noted whether or not a click was

TABLE 2. Patient demographics and percent change in Oswestry Disability Index (ODI) scores from the initial examination to the third visit.

Patient	Age (y)	Gender	Duration of Current Episode (d)	ODI Baseline (%)	ODI Follow-up (%)
1	42	Male	14	46	18
2	28	Male	35	34	14
3	37	Male	24	56	22
4	33	Female	10	34	12
5	54	Female	14	46	22
6	46	Male	148	58	24
7	42	Female	19	32	14
8	39	Male	29	40	16
9	25	Male	15	46	18
10	50	Female	8	42	20
11	37	Male	120	32	22
12	29	Female	30	36	12
	39 (8.9)*		19†	41.8 (8.8)*	17.8 (4.2)*

* Mean ± SD.
† Median.

either heard or felt by the therapist or patient. If a click was noted, the physical therapist proceeded to instruct the patient in the range-of-motion exercise. If no click was produced, the patient was repositioned and the manipulation was attempted again. If no click was experienced in the second trial, the therapist attempted to manipulate the opposite side. The therapist performed a maximum of 2 attempts per side. If no click was produced after 4 attempts, the therapist proceeded to instruct the patient in the range-of-motion exercise. Following the development of the CPR, it was identified that a click occurring with a manipulation was not associated with a successful outcome.[9] However, to maintain consistency with the Flynn et al[3,8] and Childs et al[3] studies, we elected to use the same treatment algorithm.

The posterior pelvic tilt range-of-motion exercise was completed in the physical therapy clinic immediately after the manipulation. Patients were asked to lie on their back and bend their hips and knees so that their feet were flat on the surface of the table. Patients were then instructed to attempt to flatten their back to the table by slightly ''drawing in'' their stomach and rotating their hips backwards, without holding their breath. The patient was then instructed to perform this exercise in a pain-free range of motion. Each patient was instructed to perform 10 repetitions of the exercise 3 to 4 times daily at home. On the second physical therapy visit, all patients were treated with the identical manipulation technique and range-of-motion exercise, as described above.

Follow-up Measurements

To be consistent with the study that developed the original CPR,[8] all patients again completed the ODI on the third visit (approximately 1 week after the initial visit) to determine if they had achieved a 50% reduction in perceived disability.

OUTCOMES

A total of 29 consecutive patients referred to physical therapy with LBP were screened for eligibility criteria. Fifteen patients satisfied at least 4 of the 5 criteria for the CPR. Of these 15, one was excluded as a result of exhibiting neurological signs (diminished reflexes and myotomal strength) and 2 others that met the CPR were not included, as their ODI scores was less than 30% (18% and 12%). A total of 12 (41.4%) patients participated in the case series. Of those that participated in the study, 92% exhibited at least 35° of internal rotation of 1 hip, 92% did not have symptoms distal to the knee, 83% exhibited a FABQW subscale score of less than 19, 83% exhibited hypomobility of the lumbar spine at 1 or more segmental levels, and 42% exhibited symptom duration of less than 16 days.

Of the 14 patients that did not meet the CPR, 86% did not meet the criterion of less than 16 days, 64% did not satisfy the criterion of the FABQW subscale, 43% did not satisfy the criterion of no symptoms below the knee, 29% did not satisfy the criterion of hip internal rotation greater than 35°, and 21% did not present with hypomobility of the lumbar spine.

Demographic information for each patient, as well as baseline and follow-up ODI scores, can be found in Table 2. The mean age of the group was 39 years (SD, 9 years) and the median duration of symptoms was 19 days (range, 8-148 days). The mean number of days between the first visit and re-examination on the third visit was 7 days (SD, 2 days). For the 12 patients, the mean reduction in disability as measured with the ODI was 57% (SD, 9%). Only 1 patient did

not exceed the 50% reduction in ODI required for a successful outcome (Figure 3).

Discussion

The results of our case series demonstrate that 11 out of 12 patients (91.7%) experienced a successful outcome, defined as a 50% or greater reduction in disability, within 2 treatments, using an alternative lumbar side-lying manipulation. These results suggest that the recently developed manipulation CPR might not be isolated to the specific manipulation technique that was used to derive and validate the rule (Figure 1). The 92% success rate achieved is only slightly lower than that achieved in the Flynn et al[8] derivation study and identical to that of the Childs et al[3] validation study. It is possible that the CPR identifies patients with LBP who are generally likely to benefit from any form of high-velocity thrust manipulation directed towards the lumbopelvic region.

Traditionally, decision making related to manual therapy techniques has been based on identifying specific biomechanical restrictions during joint play and movement assessment, and then directing a treatment technique as specifically as possible to the identified restriction to achieve optimal outcomes.[13,16,20] However, recent evidence using dynamic MRI has suggested that the effects of manual therapy techniques are not specific to the targeted level.[17,18] In addition, studies[2,22] that have investigated the location of clicks during spinal manipulation have suggested that manipulation is neither specific nor localized to 1 specific segment. Ross et al[22] demonstrated that less than 46% of manipulation techniques in the lumbar spine were found to accurately produce clicks at the targeted spinal levels. Beffa and Mathews[2] investigated the location of the click occurring during a manipulation directed at L5 and one directed at the sacroiliac joint. The 2 manipulations did not produce clicks at different locations and were not specific to the segment targeted. If manipulation techniques are not as specific as clinicians have traditionally believed, the choice of one technique over another may be less important than previously thought.

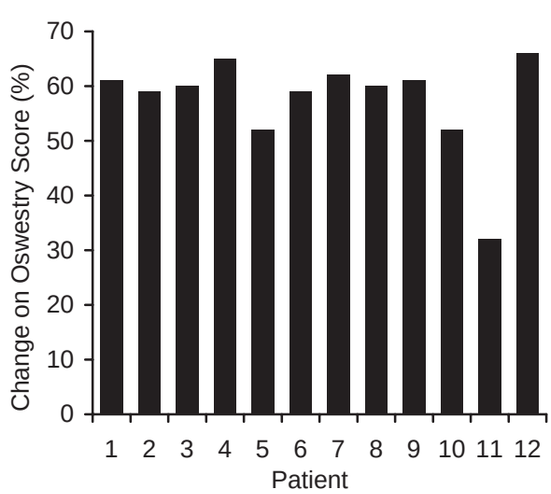

FIGURE 3. Percent improvement in Oswestry scores for each patient.

While the biomechanical literature and studies investigating the location of the clicks occurring during manipulation are clinically relevant, the ultimate criterion for determining the effectiveness of any treatment technique is the impact on patient outcomes.[23] Chiradejnant et al[4] demonstrated that patients with LBP who received 1 session of mobilization directed at the lumbar spine with the specific technique selected by the treating clinician or a randomly selected technique had no difference in any of the patient-centered outcomes measured. In addition, Haas and colleagues[14] demonstrated that manipulation directed towards segmental impairments versus randomly selected manipulation achieved similar reductions in pain and stiffness among patients with mechanical neck pain, concluding that the site of manipulation might not be clinically important.

The results of this case series should be interpreted with caution as we can not infer a cause-and-effect relationship between the manipulation technique and outcomes experienced by the patients. However, the results of this study offer preliminary hypotheses for future research to determine whether patients who satisfy the CPR developed by Flynn et al[8] might benefit from high-velocity thrust manipulation directed toward the lumbopelvic region, regardless of the manipulation technique that is used. If this hypothesis proves to be true, and the CPR is useful regardless of the manipulation technique used, therapists may have the freedom to choose a technique that is the most comfortable for both the patient and the therapist, and not be restricted to a single technique. Future randomized clinical trials should be designed to evaluate the long-term patient outcomes in patients satisfying the CPR comparing different types of manipulation techniques.

CONCLUSION

Ninety-two percent of the patients in this case series who satisfied the CPR and were treated with an alternative lumbar manipulation technique demonstrated a successful outcome within 1 week. Future research should investigate the long-term outcomes associated with different lumbopelvic manipulation techniques to determine if the specific technique utilized matters or simply that patients satisfying the CPR will improve rapidly in response to any high-velocity spinal manipulation directed at the lumbopelvic region and a range-of-motion exercise.

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