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Rehabilitation versus spine surgery: a narrative review of role of rehabilitation in lumbar degenerative spine conditions

Abstract

This article presents a focused review on the role of rehabilitation in lumbar spine pain. Rehabilitation treatments are commonly used in the treatment of spine pain, before and after surgical operations. There is broad variation in rehabilitation treatments which makes assessment of effect very difficult. Rehabilitation is effective in the treatment of lumbar spine pain, and in some cases is as effective as surgery. Surgical outcomes can be superior for nerve compression and instability. Physical activity immediately after common spine operations improves outcomes but the incremental benefit appears small for most patients. When compared to surgical treatment, rehabilitation is remarkably safe. For patients with complex pathology, complicating medical conditions, difficult psychological or social situations, or those who do not improve after surgical intervention, intensive rehabilitation can often improve pain and function over many years.

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Introduction

Spine pain is prevalent and costly. It is the leading cause of disability in working-age adults and continues to cause pain and reduced quality of life in the elderly.[1] Before proceeding to spine operations, nearly every patient with spine-related pain has exhausted "conservative" nonsurgical measures." These measures may include activity modification, analgesic medication, injections, spinal manipulation, and acupuncture. Conservative measures nearly always include efforts at rehabilitation. Rehabilitation is the starting point and ending point for many patients who experience spine pain. This paper will briefly review the role of exercise and rehabilitation in the continuum of treatment for lumbar spine pain.

A brief discussion of rehabilitation

Rehabilitation is a behavioral intervention to help participants perform activities that they value. This is an extremely broad definition, but captures the essence of the complexities of rehabilitation. The application of physical modalities (like TENS, iontophoresis, therapeutic ultrasound, ice or heat) physical conditioning, motor control exercises, manipulation, myofascial body work, strengthening exercises, stretching, casting, bracing, taping, electrical stimulation of motor nerves, mental exercises, mindfulness, cognitive restructuring, and addressing fear of movement are all considered rehabilitation methods. Typically combinations of these methods are used to help patients attain functional goals.

One of the major limiting factors in rehabilitation research and practice is that spine rehabilitation is not standardized, and enormous variety exists within and between practices. The available literature assessing the use rehabilitation methods in the management of spine pain or comparing surgical to non-surgical treatment is often limited by heterogeneity of conservative methods used. The most common application of rehabilitation in spine care is physical therapy. The clearest description of physical therapy techniques applied in research of spine pain still leaves gaps in the content, application, duration, progression of exercises, and individualization of care. This profoundly limits broad application of research findings, and is further confounded when physical therapy is applied in the community, outside of the constraints of a research study. This is a challenge in the field of spine care which already marked by fragmentation of care and heterogeneity.[2] Nevertheless, when evidence is synthesized from the available physical therapy literature and guidelines for therapy followed, outcomes improve.[3]

Rehabilitation as an initial intervention

Acute low back pain characteristically resolves spontaneously, though recurrence and changes in presentation are common.[4] In the absence of alarming signs or symptoms, watchful waiting is recommended, with education, analgesics and exhortation to maintain some physical activity.[5] Specific exercises are generally not recommended during this period. Most guidelines recommend considering psychosocial factors that may mediate against recovery.[5] Specific educational programs attempt cognitive restructuring to reduce the impact of back pain related disability.[6,7]

When pain does not abate within weeks, the next step is commonly physical therapy. Physical therapy initiation within 14 days of presentation may decrease subsequent utilization of health-care resources[8] though this finding is not replicated in all studies.[9] Physical therapy at this stage nearly always includes exercise training, but may include passive modalities and manipulation, and should address fear avoidance beliefs.[3,10] The data and guidelines are not yet clear on which patients improve with which treatments or exercises. There is no data to definitively support the superiority of one exercise program or movement system over other options, to support specific exercises over a general fitness program, to favor one-on-one over group setting, or to suggest appropriate dosing of exercise.[11] There is promising research to tailor delivery of specific interventions to those most likely to respond.[12–14] Most individuals with spine pain do not require clinical intervention to improve even with severe acute back pain, but individuals with psychosocial risk factors benefit most from

integrated interventions. The fear-avoidance model has been broadly accepted as describing a negative prognostic factor for recovery from spine pain .[10] Catastrophization has likewise been implicated in poor recovery.[15]

Compelling work from Keele University demonstrates the importance of psychosocial screening and stratification on the efficacy of treatment for spine pain.[14] This approach decreases cost and improves outcome, including pain, disability, quality of life and time off work. Satisfaction is high for those randomized to the stratification arm of this study, which minimized clinician contact with patients at low psychosocial risk, and graded the level of clinician contact through medium- and high-risk patients. Interestingly, greatest cost-savings was derived from the limited contact between low-risk individuals and physical therapists.

Alternatively, using an even more physically and psychologically intensive intervention for high-risk individuals early in treatment may be a cost-effective strategy.[16–18] This high-input model of treatment for high-risk injured workers results in lower costs in terms of medical visits, medication use, and lost wages, as well as less pain and disability. There is clearly a role for exercise in the treatment of subacute and chronic spine pain. It has been broadly recommended in most major guidelines.[5] There is not enough evidence to support any specific exercise approach (such as aerobic exercise, weight-lifting, tai-chi, or yoga) over others, but improvements in mood, function, and health can be expected with regular use of exercise as a part of a spine pain management plan.[19]

Cost-effectiveness analyses are few for non-operative care for spine pain, and are confounded by heterogeneity of treatment.[20] These cost-effectiveness studies can only report the relative superiority of specific treatments that have been studied in specific protocols, rather than propose a strategy that is broadly cost-effective.[20] One analysis within the United Kingdom of treatment for sciatica purports to demonstrate the cost-effectiveness of sequential escalation in treatment, including non-opioid medication, exercise, epidural steroid injections, and possibly alternative treatments compared to direct referral to surgery.[21]

Direct comparison of surgery and rehabilitation

Several studies have directly compared surgery to non-operative care. A systematic review presented the results of five randomized studies that compare conservative care to discectomy for sciatica from herniated nucleus pulposus.[22] Most studies were difficult to interpret due to high risk of bias and poor reporting of patients or outcome. The findings generally support a faster recovery from pain in surgically treated patients, but that medium and long-term outcomes are similar between the groups. Non-operative care was not however, structured or standardized. This allows face-validity for comparison to practice as usual but does not truly compare operative management to structured rehabilitation in an interdisciplinary spine center.

A study with patients diagnosed with isthmic spondylolisthesis randomized into physical exercise or fusion showed that function and pain outcomes favored those treated with surgery.[23] Three serious neurological injuries were reported in the surgical group while none were reported in the exercise group. Adherence to the program in the exercise group was poor. A long-term average 9 year follow-up demonstrated that there was a progressive decrease in the early gains offered by surgical intervention, though surgical patients continued to demonstrate improved outcomes compared to those in the exercise arm.[24]

In a study by Fritzell et al.[25] patients with chronic low back pain and disc degeneration were randomized to non-surgical treatment (including physical therapy, modalities, injections, education, cognitive support and coping strategies) or up to two level fusion at the lower lumbar spine. This study demonstrated superiority of surgery to the non-surgical intervention especially at the 6 month mark, with diminishing magnitude of effect by the 2 year follow-up. Cost analysis demonstrated superiority of surgery, especially given the increased return to work rates in the surgical group.[26] The randomized study was criticized because the non-surgical treatment was not standardized and did not offer the most effective non-surgical treatment. Essentially, the non-surgical treatment resembled "treatment as usual", not structured rehabilitation.[27] It is relevant that there is modest data from these publications to suggest that patients with personality disorders or high levels of depression or neuroticism may be best served with conservative management as opposed to surgical treatment.[28]

Brox et al.[27] randomized patients with chronic low back pain and disc degeneration to either up to two level fusion at the lower lumbar spine or structured rehabilitation including physical and cognitive intervention without a psychologist over a period of 5 weeks. It should be noted that the surgical group also underwent post-operative physical therapy. Nevertheless, there was no statistically or clinically significant difference noted between the groups in major endpoints, and both groups experienced improvement in their Oswestry Disability Index at the end of the trial. Secondary endpoints showed that fear-avoidance beliefs and finger-floor distance favored the rehabilitation group, while improvement in leg pain favored the surgical group. Independent assessment of success using pre-defined criteria and return to work favored rehabilitation. Again complications were noted only in the surgical group. In an intriguing twist, participants in both groups reported strong beliefs in the efficacy of surgery both before and after completing treatment, despite the similarity in outcomes.

A second study by the same group randomized patients who had a previous discectomy to similar treatment groups.[29] Nearly half of patients who underwent fusion or rehabilitation met the criteria for success after one year. There were no clear differences in the endpoints for the groups. Both studies from these groups may have been underpowered to detect differences, but since the predefined clinically important differences were not met a further increase in statistical power would not demonstrate clinical superiority of either treatment.

Fairbank et al.[30] randomized patients with chronic low back pain and disc degeneration to surgery or 3 weeks of supervised graded physical activity, most often with supervision from psychologists. The result was only marginal relative benefit in Oswestry Disability Index for the surgical group. This barely exceeded the mean clinically important difference chosen by the authors. Both groups experienced significant improvement in clinical measures at the end of the two year follow-up. The authors emphasized the risk of operation, as the only adverse events in the trial were associated with surgical intervention. Cost-analysis of the data from this trial suggested that surgical stabilization for degenerative discs in the lower lumbar spine was not cost-effective compared with the structured non-surgical care.[31]

Hellum et al.[32] used a randomized controlled trial to compare lumbar disc arthroplasty at up to two levels in the lower lumbar spine against structured rehabilitation. The result favored the surgical group statistically, but not enough to convince the authors there was a true clinical difference. Both groups demonstrated significant improvement in quality of life. A cost analysis of the use of disc arthroplasty was challenging; the use of different measures of quality of life yielded contradictory evaluations of cost-efficacy.[33]

The SPORT trials a combination of randomized and observational data collected over years in the United States, also lend insight into the use of surgical and non-operative care. The most remarkable deficit in this data is the inconsistent randomization. There was extensive cross-over between the groups, resulting in an intention-to-treat analysis that cannot differentiate the effect of surgery and conservative care. The second limiting issue is non-standard conservative care; there was no consistency in the delivery or participation in non-surgical treatment. Nevertheless, the randomized as-treated portions of the trial are very informative. Spinal stenosis, herniated lumbar disc, and degenerative spondylolisthesis demonstrated benefits of surgical management over continued conservative care that were most apparent in the first few months, but which persisted at 4 years of follow-up.[34–36] Interpretation of the efficacy of non-standard conservative care is difficult, however; a different observational study of microdiscectomy to community-level conservative management for patients with herniated nucleus pulposus noted treatments that were variable and "mostly not compliant with major guidelines".[37]

A review of cost-effectiveness of spine treatments came to the conclusion that when spinal disorders cause nerve compression or instability operative treatment leads to superior outcomes, while spine syndromes without these features do not favor operative treatment.[20] As our understanding of the spine improves and our technology advances, more precise diagnosis and more targeted treatment may allow more definitive treatment of specific anatomical sources of pain that currently are not recognized or adequately addressed. An intriguing message from the aggregation of these studies is that structured rehabilitation including graded activity and cognitive restructuring is consistently associated with better performance of the non-operative groups. It is a matter of speculation whether a broad application of structured rehabilitation in the remaining studies could narrow the gap between surgery and conservative care. An indisputable fact from these studies is that no serious adverse events were noted during participation in rehabilitation or conservative care.

Rehabilitation as a surgical adjunct

It is common practice to limit surgical procedures for painful spine syndromes to those patients who have participated extensively in physical therapy. It is also common to include physical therapy in the postoperative period, as in surgical studies cited in the last section.

A Cochrane review has offered some insights into the utility of rehabilitation efforts in the post-operative period for lumbar disc surgery.[38] There is low-quality evidence to support that physical therapy and vigorous activity at 4-6 weeks after operation leads to less pain and disability. There is not an increased risk of repeat operation in those who participate in early therapy or exercise. There does not seem to be an incremental benefit of supervised exercise over unsupervised exercise. There remains inadequate evidence to help select patients for whom post-operative rehabilitation is necessary or useful. The overall effect of postoperative rehabilitation seems to be small, and is likely dwarfed by the effect of the operation in studies that do not show a significant effect.[39,40] Another Cochrane review has found similar themes in rehabilitation after decompression for lumbar stenosis.[41] Early active rehabilitation seems to lead to improved function and pain compared to usual care and the effect is small.

These studies describe operations and patient selection processes where outcomes are expected to be very good in a high proportion of patients, so the effects of rehabilitation are very likely to be small. Several of the studies noted in this review have emphasized the importance of psychosocial risk factors in recovery from lumbar spine pain. It is clear that structured rehabilitation can maximize recovery for elective surgical spine patients with significant psychosocial risk. For example, complex occupational spine injury patients characteristically have poor outcomes after lumbar spine surgery.[42,43] For these patients a highly intensive, highly structured rehabilitation program administered with lumbar spine surgery can yield acceptable outcomes.[42,43] Perhaps a broader application of rehabilitation with integration of cognitive restructuring could improve outcomes for traditional surgical patients with fear avoidance beliefs or psychosocial confounders. Finally, participation in a rehabilitation program can help patients minimize ambivalence about participation in elective spine surgery, with lasting effect on decisions and acceptance of care pathways.[44]

Functional restoration

A review of the available literature leads to the conclusion that surgical treatment of the anatomical correlates of most spine pain syndromes is effective, especially in the short term. Yet there are always failures of medical and surgical management, even in successful trials of the most successful interventions. And there are patients with spine pain who do qualify for a spinal operation, due to absence of an identifiable anatomical lesion, significant medical comorbidities, or absence of a viable surgical option after multiple operations.

For these patients, rehabilitation is often the only remaining treatment. Fortunately, there is a robust literature on the role of intensive and structured rehabilitation called "functional restoration" in the management of pain and disability for these patients. Even in patients who have disability and pain after multiple failed treatments and operations, quality of life can improve and persist for many years after intensive rehabilitation.[45–48] It is the success of intensive rehabilitation programs when all else has failed that speaks to the profound effectiveness of the approach. Cost-effectiveness evaluations are complex for this approach and do not allow clear conclusions, but seem promising based on preliminary valuations.[49]

Collaboration for care

There is very little data on the effect of partnership between experts in rehabilitation, interventional spine management, and surgeons to deliver high quality care. Where possible, a team approach is preferable to care that is partitioned among specialists, to ensure continuity of care. A set of protocols specific to local expertise for assessment and treatment of spine pain syndromes can help improve communication between the clinicians participating in care and can help standardize the message between the clinicians and patients.

Conclusion

Rehabilitation is effective early in the presentation of lumbar spine pain syndromes. It is difficult to assess the effects of rehabilitation in the literature on lumbar spine pain due to heterogeneity of practices

and variation in application, but in aggregate, rehabilitation methods are effective and extremely safe. When compared to surgical procedures, structured rehabilitation is as effective for low back pain from degenerative disc disease. When compared to surgical procedures, unstructured rehabilitation is not as effective in the short-term for nerve compression or spinal instability, though the long-term outcomes do not favor surgery as profoundly. It is possible that a more structured rehabilitation intervention would result in a more favorable outcome for non-operative treatment. Early post-operative rehabilitation seems mildly beneficial to recovery without increasing risk of reinjury. Rehabilitation seems most effective in patients with significant psychosocial comorbidities, and intensive rehabilitation is the most effective way to manage high-risk patients at any point in their presentation of lumbar spine pain. Even when spinal surgery and other efforts have failed to relieve pain and disability, intensive rehabilitation can provide long-term improvement in pain and disability.

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Conflict of interest

The author declares no conflict of interest.

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