ELSEVIER

The Spine Journal 5 (2005) 24–35

THE SPINE JOURNAL

2004 Outstanding Paper Award: Nonoperative Science

Discographic, MRI and psychosocial determinants of low back pain disability and remission: a prospective study in subjects with benign persistent back pain

Eugene J. Carragee, MD, Todd F. Alamin, MD, Jonothan L. Miller, MD, John M. Carragee, MBA*

Stanford University School of Medicine, 300 Pasteur Drive, Room 171, Stanford, CA 94305 USA

Received 19 January 2004; accepted 13 May 2004

Abstract

BACKGROUND CONTEXT: A range of morphologic and psychosocial variables has been suggested as risk factors for serious low back pain (LBP) illness. Although the relative contributions of structural and psychosocial variables are intensely debated, the validity of differing hypotheses has proven difficult to test because the incidence of serious disabling LBP illness is low in healthy subjects. These factors dictate the requirement for large sample sizes, extensive structural imaging and extended longitudinal study. Previous studies included either small cohorts with intensive imaging testing or large population studies that do not establish a detailed morphologic baseline.

PURPOSE: To establish, using a strict patient sample design, the relative contribution of structural and psychosocial determinants of serious LBP illness among subjects with no previous LBP disability or clinical LBP illness.

STUDY DESIGN/SETTING: A prospective, longitudinal study of subjects with high risk factors for serious LBP as determined by structural and psychosocial characteristics.

PATIENT SAMPLE: One hundred subjects with known mild persistent low back pain and a 2:1 ratio of chronic (non-lumbar) pain syndrome were recruited from a study population with a predisposition to disc degenerative disease, to undergo baseline examination, testing and 5-year follow-up.

OUTCOME MEASURES: Observations were made at 6-month intervals over 4 to 6 years (mean, 5.3) for the after primary outcomes measures: episodes of serious back pain (visual analogue scale [VAS]$\geq$6), episodes of occupational disability less than 1 week, episodes of occupational disability for 1 week, remission episodes of all back pain symptoms at least 6 months and medical visits primarily for LBP evaluation and treatment.

METHODS: Lumbar magnetic resonance imaging (MRI), lumbar provocative discography (in psychometrically normal subjects), physical examinations, medical and work histories and psychometric testing were performed at baseline. Imaging and psychometric testing were graded by blinded examiners. A scripted interview was conducted every 6 months during follow-up by independent research assistants who also were blinded to patient baseline data. The interview covered interval medical, occupational and accident or injury histories.

RESULTS: Psychosocial variables strongly predicted both long- and short-term disability events, duration and health-care visits for LBP problems ($p<0.0001$–0.004). The likelihood of a sustained remission from the baseline persistent (subclinical) LBP appeared to be linked to occupation factors (leaving a heavy labor occupation; $p=0.0001$), neurophysiologic variables (chronic nonlumbar pain; $p=0.0002$) and psychometric profiles at baseline (DRAM and FABQ-PA; $p=0.003$–0.002). Of the structural findings measured only moderate or severe Modic changes of the vertebral end plate

FDA device/drug status: not applicable.

Funding to complete this study was received from the AO Foundation and Department research funding at Stanford University. Nothing of value received from a commercial entity related to this research.

* Corresponding author. Stanford University School of Medicine, 300 Pasteur Drive, Room 171, Stanford, CA 94305, USA. Tel.: (650) 725-6797; fax: (650) 723-9805.

E-mail address: carragee@leland.stanford.edu (E.J. Carragee)

doi:10.1016/j.spinee.2004.05.250

were weakly associated with an adverse outcome. A positive provocative discogram at baseline did not predict any future adverse event.

CONCLUSION: The development of serious LBP disability in a cohort of subjects with both structural and psychosocial risk factors was strongly predicted by baseline psychosocial variables. Structural variables on both MRI and discography testing at baseline had only weak association with back pain episodes and no association with disability or future medical care.

Keywords: Back pain; MRI; Discography; Degenerative disc; Annular fissure; Spine trauma; Smoking; Psychological distress

Introduction

Low back pain (LBP) associated with functional decline or disability is a common and costly medical and social problem [1–5]. Previous large and well-designed studies suggested that a history of LBP could be the most powerful predictor of future, serious LBP [6,7]. Other risk factors suggested to correlate with the development of significant LBP illness have included structural factors, exposure to mechanical stressors, psychological factors and social circumstances [1,2,6–19]. The relative contribution of psychosocial versus structural factors has been the subject of controversy and debate.

Some investigators suggested that it is the morphologic status of the intervertebral disc complex, specifically the annulus or end plates, that primarily determines the presence and degree of low back problems [8,15,20–22]. Others suggested that disabling LBP illness is determined in large part by psychosocial or neurophysiologic factors (somatic distress, pain amplification, depression, secondary gain, etc.) [4,6,11,12]. Which of these hypotheses could in fact be most valid has proven difficult to test using standard epidemiologic methods. Because the incidence of serious disabling LBP illness is low, resources have not allowed a sufficient number of subjects with defined degenerative changes (magnetic resonance imaging [MRI] or other imagining) and "at risk" psychosocial variables to be followed in a prospective fashion.

In previous studies risk factors were assessed in chronic LBP treatment groups and prospectively in occupational settings or in population cohorts. Few of these studies defined the spinal degeneration status with MRI, discography, or both findings. Small cohorts of asymptomatic subjects have been followed after magnetic resonance (MR) scanning or discography of the lumbar spine, but the subject numbers were small and these studies were inconclusive because of low statistical power [11,13,14,23]. Because the incidence of serious or disabling LBP problems is relatively small in healthy individuals, prospective trials performed on an asymptomatic group are likely to lack the statistical power to detect significant trends without an extremely large sample size and extended follow-up.

However, by studying a medium-sized cohort of subjects (n=100) with baseline profiles suggested in previous literature to correlate with increased incidences of serious LBP illness, the predictive power of analysis is substantially increased. That is, a cohort of subjects, for instance, with a known propensity for degenerative disc disease, psychological distress or both would be expected to have a higher (and therefore measurable) incidence of future serious LBP illness. A prospective observational study of reasonable size could analyze the rates of serious adverse LBP outcomes.

As cited above, previous investigations indicated that persons with previous or current nondisabling LBP are at a greater risk of developing serious LBP problems and disability [6,7,9]. We selected such a group with a history of LBP as the primary group for this study to increase the statistical power of the sample. Then, systematically recruiting a cohort of subjects with chronic mild LBP, a propensity to degenerative disk disease (DDD), chronic pain and psychological distress at baseline would allow their relative predictive effects to be studied within a manageable cohort size. To our knowledge, a group with ongoing benign back pain but no serious LBP problems has never been studied for the above-mentioned factors in a prospective manner to determine the natural history or predictive factors determining eventual outcomes.

Therefore, to define the predictive factors for serious LBP problems we selected a cohort of subjects with ongoing mild LBP pain, without current or past LBP disability but a known propensity to DDD. This study examined such a cohort at baseline for radiographic, MRI and discographic evidence of structural changes, as well as demographic, occupational and psychometric features. We then followed this group over 5 years with interval assessments for LBP problems and reported on the subsequent values of baseline variables to predict future significant LBP variables.

Methods

Study design

This study was a prospective, longitudinal, observational study designed according to statistical power analysis (see "Power analysis") to investigate the effect of spinal degenerative factors and nonspinal factors on the subsequent development of LBP episodes. All subjects recruited had known risk factors for degenerative lumbar disc disease and a history of mild, persistent but nondisabling LBP. Subject selection was biased (2:1) to subjects with a history of chronic nonlumbar pain, because this group is known to have both high incidences of both psychological distress and presumed