Early VAS reduction speed predicts the treatment outcome in acute low back pain

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Abstract

The speed of change in pain intensity as measured by the visual analog scale (VAS) was investigated in patients with acute low back pain (LBP). Each patient was initially treated with oral nonsteroidal anti-inflammatory drugs (NSAIDs). Clinical outcome was determined by patient self-assessment on the day of the last visit and classified into four groups: healed, improved, marginal, and unidentified. Data were analyzed for 131 cases in the healed (n=55), improved (n=62), and marginal (n=14) groups. VAS values at the first and last visits were denoted as VAS–f and VAS–l, respectively. ∆VAS, the speed of change in the VAS value per day was calculated by dividing the change in the VAS value by the number of days elapsed. The initial ∆VAS (∆VAS–i) and the ∆VAS throughout the study (∆VAS–t) were calculated between the first and second visits and between the first and last visits, respectively. VAS–f was not relevant to outcome, while VAS–l was strongly correlated with outcome, as expected. Both ∆VAS–i and ∆VAS–t were significantly correlated with outcome. Patients in the healed and improved groups showed higher ∆VAS–i values as compared with those in the marginal group. A ∆VAS–i over 5 mm/day predicted favorable outcomes. The ∆VAS–i can be regarded as a predictor of outcome in acute LBP. Speedy pain relief should be planned for patients with acute LBP with a low ∆VAS–i to prevent a change to chronic LBP.

Keywords

Acute low back pain; Visual analog scale (VAS); Speed of change in VAS (∆VAS); Treatment outcome; Prognosis; Predictor

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Introduction

Most cases of acute low back pain (LBP) are benign. The majority of patients with acute LBP recover within three months \(^7,9\). A few patients, however, complain of persistent pain, resulting in chronic LBP. The cutoff time point that demarcates acute and chronic LBP has not been established \(^11\). There are several criteria for chronic LBP that relate to pain duration. Currently, chronic LBP is a common disease that causes social and medico–financial problems in industrial countries. An important role of primary care physicians is to prevent acute LBP from progressing to chronic LBP \(^10\).

Authorized questionnaires for LBP such as the Roland–Morris Disability Questionnaire (RDQ) \(^17\) and the Oswestry Questionnaire \(^4\) reveal physical and psychological conditions underlying chronic LBP \(^12,15\). In Japan, the Japanese Orthopaedic Association Back Pain Evaluation Questionnaire (JOABPEQ) was recently established (2007–2009) after a large–scale pilot study \(^6\). It is now not only a domestic standard LBP questionnaire \(^1,2\), but it is also used abroad \(^3\). Screening instruments to identify prognostic factors of LBP have been reported \(^14\). Factors leading to chronic LBP that can be found at the first examination or in the early stages have been investigated \(^10,14\). Previous studies have indicated that psychological factors, emotional distress, and work status are strongly associated with chronicity \(^7,8,14\). However, none has been clarified as a cardinal risk factor.

The orthopedic department of our hospital and its satellite clinic to which the present author reports, serve as local orthopedic primary care institutions. One orthopedist specialized in treating LBP, the author of the present study, examines a maximum of 10 new patients with LBP every day. LBP questionnaires and the JOABPEQ can be completed at the first visit, but they are difficult to incorporate into every visit. Furthermore, a recent study revealed that the JOABPEQ score at the first visit is not prognostic in acute LBP \(^19\). Simple and reliable clinical findings that identify early–stage patients at risk for unfavorable outcomes are desired \(^14\).

Pain is the chief complaint, and often the only sign in patients with LBP, so pain intensity data are the most important in the assessment of LBP. The visual analog scale (VAS) is a widely used, universal, standard tool for the measurement of pain intensity \(^5,13,16\). However, the author reported that pain intensity represented by the VAS score and the degree of disability and quality of life were weakly correlated with each other either at the first visit and 15 days later \(^11\). This suggested that the VAS value in the early stage cannot predict outcome.

The change in the value of the VAS from before to after treatment is an efficacy indicator in clinical and basic studies of pain. The difference in the change in VAS between a study group and a control group is a standard measure in pain studies. However, this measure cannot predict treatment outcome. We measured the VAS value of our patients with LBP at every visit. We noticed that patients with favorable outcomes tended to report quick reductions in VAS values in the early stage, regardless of the initial VAS value. We hypothesized that the speed of reduction in the VAS value (ΔVAS), not the VAS value itself, is correlated with clinical outcome. LBP was defined as pain perceived on the body surface area rostrocaudally between the thoracolumbar boundary (T/L) line and the gluteal fold and dorsoventrally between the right and left dorsal...
and ventral boundary (D/V) lines in the back. Pain perceived in this area is caused by disorders in the lumbar spine and sacrum and related muscles and ligaments, and is not of radicular origin. The scientific basis of this concept was described in a book published recently 18).

Materials and Methods

Subjects

VAS data from patients with LBP who met the following criteria were investigated retrospectively: 1) Pain persisting less than one month from the onset of pain at the first visit. 2) Patients who visited more than one time: This criterion was included because the calculation of ∆VAS requires two VAS values recorded at different visits. 3) Patients with bone tumors, osteoporotic vertebral fractures, and infectious conditions were excluded. 4) Patients were also excluded if they could not understand written Japanese sentences. Consequently, VAS data of 148 patients who met the criteria were analyzed.

Patients were given options for the day of their next visit. Accordingly, intervals between visits were irregular for each patient. The number of visits differed among patients, ranging from a minimum of one (the first re-examination only) to a maximum of 14.

VAS and ∆VAS

Patients were asked to rate their pain intensity with the VAS at every visit. We used a handy standard 100-mm horizontal bar VAS scale on which the left border (0 mm) was denoted as “no pain” and the right (100 mm) as “worst pain imaginable”. The speed of change in the VAS value (ΔVAS) between the two visits was calculated by dividing the change in VAS value by the number of days elapsed. A positive ΔVAS represents a reduction in the VAS value. Two types of ΔVAS values, ΔVAS–i and ΔVAS–t, were calculated. Here ΔVAS–i, the initial ΔVAS, was calculated as the ΔVAS between the first and the second visits. ΔVAS–t, the ΔVAS throughout the study, was calculated as the ΔVAS between the first and last visits. ΔVAS–i represents the change in VAS values in the early period of treatment.

Treatments

Every patient who met the inclusion criteria was prescribed oral and externally applied NSAIDs at the first visit, regardless of diagnosis, VAS–f value, and JOABPEQ score. Other treatments, such as vitamins and pregabalin, trigger point injections, nerve blocks, and physical therapies, were considered after the second visit when the initial treatments with NSAIDs were clearly insufficient for pain reduction.

Judgment of treatment outcome

There are no uncontroversial criteria regarding the efficacy of treatment. The only criterion, that could be widely accepted is a VAS of 0 = no pain. We routinely ask patients their self-evaluation of pain relief at every visit. In this study, the patient-based evaluation was classified into four groups: healed, improved, marginal, and unidentified. Clinical outcome was determined by the last medical record. Patients who reported that they had healed and did not need further examinations and treatments were classified into the healed group. Those who expressed that their pain was reduced from the first visit were classified into the improved group. Patients who expressed that their pain had not changed or deteriorated from the first
visit were classified in the marginal group. When no information on pain reduction was obtained, patients were classified into the unidentified group. Statistical analyses were performed for the data in the healed, improved, and marginal groups.

**JOABPEQ**

The JOABPEQ contains five categories: low back pain, lumbar function, walking ability, social life function, and mental health. Patients are asked to answer 25 questions relating to these categories. Each category is scored on a scale ranging from 0 (representing the worst condition) through 100 (representing the best condition) 6).

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**Table 1 Demographic characteristics of the 148 patients**

<table>
<thead>
<tr>
<th></th>
<th>healed</th>
<th>improved</th>
<th>marginal</th>
<th>unidentified</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of subjects</td>
<td>55</td>
<td>62</td>
<td>14</td>
<td>17</td>
</tr>
<tr>
<td>Gender (male : female)</td>
<td>31 : 24</td>
<td>34 : 28</td>
<td>10 : 4</td>
<td>9 : 8</td>
</tr>
<tr>
<td>Age (mean ± S.D.)</td>
<td>43.4 ± 16.6</td>
<td>44.8 ± 15.1</td>
<td>47.8 ± 19.5</td>
<td>40.9 ± 14.9</td>
</tr>
<tr>
<td>Duration of visit (days) &lt;min – med – max&gt;</td>
<td>2 – 9 – 106</td>
<td>1 – 7 – 110</td>
<td>3 – 17 – 93</td>
<td>1 – 7 – 42</td>
</tr>
</tbody>
</table>

S.D.: standard deviation; min: minimum; med: median; max: maximum.
No statistical difference in gender or age was noted among the healed, improved, and marginal groups.

**Table 2 JOABPEQ score in the 131 patients (mean ± S.D.)**

<table>
<thead>
<tr>
<th></th>
<th>healed (n=55)</th>
<th>improved (n=62)</th>
<th>marginal (n=14)</th>
<th>Kruskal–Wallis test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low back pain</td>
<td>46.1 ± 31.9</td>
<td>37.0 ± 25.5</td>
<td>45.9 ± 32.2</td>
<td>NS</td>
</tr>
<tr>
<td>Lumbar function</td>
<td>38.0 ± 33.1</td>
<td>33.4 ± 28.0</td>
<td>58.3 ± 28.2</td>
<td>$p&lt;0.05$</td>
</tr>
<tr>
<td>Walking ability</td>
<td>53.2 ± 31.9</td>
<td>51.2 ± 31.6</td>
<td>76.6 ± 28.0</td>
<td>$p&lt;0.05$</td>
</tr>
<tr>
<td>Social life function</td>
<td>45.2 ± 27.7</td>
<td>39.0 ± 21.9</td>
<td>56.9 ± 25.0</td>
<td>NS</td>
</tr>
<tr>
<td>Mental health</td>
<td>53.5 ± 16.4</td>
<td>49.8 ± 18.0</td>
<td>54.7 ± 16.9</td>
<td>NS</td>
</tr>
</tbody>
</table>

S.D.: standard deviation; NS: not significant

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**Statistical analysis**

VAS and ΔVAS values between the treatment outcome groups were statistically analyzed with the Mann–Whitney U test. Gender was analyzed with the chi–square test. Age was analyzed with a one–way analysis of variance (ANOVA). Differences in JOABPEQ scores were analyzed with the Kruskal–Wallis test. P values less than 0.05 were considered to be significant. Statistical analyses were performed with StatMate III for Macintosh (ver. 3.14, ATMS, Tokyo).
Results

**Demographic data**

Demographic data for the 148 patients who met the inclusion criteria are summarized in Table 1. Out of these 148 patients, treatment outcome was unclear in 17. VAS data for the remaining 131 patients were classified into the healed, improved, and marginal groups to be investigated in further statistical analyses. Statistical analyses revealed no significant differences in gender and age among the healed, improved, and marginal groups.

**JOABPEQ**

There were no statistical differences in the scores for pain, social life function and mental health on the JOABPEQ among the healed, improved, and marginal groups. The lumbar function and walking ability scores showed a statistical difference among the groups. Scores were greater in the marginal group (Table 2).

**VAS**

Changes in VAS values throughout the study for each of the 131 patients in the three groups are shown in Fig.1. VAS values at the first visit (VAS–f), VAS values at the last visit (VAS–l), and number of visits were conspicuously different among patients. Fig.2 shows the changes in VAS values in the first five weeks. The VAS–f was statistically higher in the healed and improved groups than in the marginal group (Fig.3), implying that the severity of the VAS value at the first examination did not correspond with prognosis. The VAS–l was statistically lower in the healed group than in the improved and marginal groups (Fig.4).

**ΔVAS**

The ΔVAS–i and ΔVAS–t values were statistically higher in the healed and improved groups than in the marginal group (Fig.5 and Fig.6). The median of ΔVAS–i was 8.8 (mm/day) for the healed group and 6.7 for the improved group, whereas it was 1.6 for the marginal group.
Fig. 2 Early changes in VAS values during the 5 weeks after the first visit. A: the healed group (n=55), B: the improved group (n=62), and C: the marginal group (n=14). Unfilled and filled symbols represent VAS values at the first visit and the last visit, respectively.
The VAS–f value in the marginal group was statistically lower than those in the healed and improved groups.

The VAS–l value in the healed group was statistically lower than those in the improved and marginal groups. The VAS–l value in the improved group was statistically lower than that in the marginal group.

The median of ∆VAS–i value in the healed and improved groups was 8.8 and 8.2, respectively. The median ∆VAS–i value in the marginal group was nearly 0.0.

The median of ∆VAS–t value in the healed and improved groups was 4.8 and 6.9, respectively. The median of ∆VAS–t value in the marginal group was nearly 0.1.
Discussion

When healed and improved cases were regarded as favorable, 89% (117 out of 131 cases) of patients with acute LBP had a favorable outcome within 100 days. Thus, the present study also confirmed the notion that acute LBP usually subsides as previous studies have reported.

It is quite natural that the ΔVAS–t was strongly correlated with treatment outcome. The ΔVAS–t should be correspond with treatment outcome, as it is another expression of treatment outcome. In contrast, the ΔVAS–i obtained in the early stage can be used as a predictor of treatment outcome. Previous studies of the factors leading to progression of acute LBP to chronic LBP have focused on static data obtained from physical findings and questionnaires. To our knowledge, this study is the first to focus on data regarding the chronological change in the patient’s condition. Patients with acute LBP with a ΔVAS–i over 5 mm/day, in other words, those who show an early VAS value reduction of over 35 mm/week, would have a favorable outcome.

The present study did not reveal factors that influence treatment outcome. There were no statistical differences in age and gender among the groups. The VAS–f, the VAS value at the first visit, was significantly lower in the marginal group. This seems counterintuitive at first glance. However, it is not uncommon in our experience. Some patients in the healed and improved groups suffered from severe acute LBP at the first visit, complaining of serious disability in moving and walking, with remarkably high VAS values. Such cases often report a speedy pain reduction. VAS values in the healed and improved groups showed a fast pain reduction, with a speed of around 5 mm/day. Patients with sprains and contusions often report a speedy reduction in pain intensity, suggesting that the pathogenesis of acute LBP is minor injury of the lumbar soft tissue or motion segments (intervertebral disc and facet joint). If this is the case, pain reduction may be achieved mainly by spontaneous repair of injured tissues with rest, not only by the effect of NSAIDs.

Factors causative for chronicity were not elucidated. Social and psychological factors have been suggested for chronicity. However, social life functions and mental conditions as scored by the JOABPEQ did not differ among groups. Patients who reported severe (VAS > 80 mm) and persisting pain were rare in the present population of patients with LBP with possible degenerative pathology. Possible factors underlying chronicity may be the duration and past history of LBP from its onset to the first visit. Patients in the marginal groups may have had chronic LBP before the first visit. This estimation will be examined in the next study.

The present results suggest another vision for the treatment of pain: a “virtuous or vicious cycle” hypothesis. Patients who undergo a fast pain reduction would be healed spontaneously due to relief from disease and confidence in medicine. However, regardless of its intensity...
pain that does not change would result in patients falling into a chronic condition due to fear of disease and distrust of medicine. This virtuous or vicious cycle mechanism may be true for disaster and crime victims. Early resolution may be cardinal for people with anxiety.

A problem of the present study is that the “final” outcome was unclear in patients in the improved and marginal groups. Patients in those two groups terminated their visits halfway through the study by their own decision. Whether those patients eventually healed or deteriorated is not known. Another problem is the existence of patients with acute LBP who had only one visit. They were excluded from the present study because a ΔVAS could not be obtained. They may have healed within a few days, or conversely, they may have consulted another hospital. The conclusions of the present study would be verified by a complete follow-up study for all patients.

In conclusion, the early speed of change in the VAS value predicted treatment outcome. Patients with ΔVAS-i over 5 mm/day were healed or improved, whereas those with ΔVAS-i around 0 mm/day were not healed. The ΔVAS-i may be a reliable predictor of treatment outcome in acute LBP. Patients with a ΔVAS-i over 5 mm/day would heal spontaneously within a month. In contrast, those with a ΔVAS-i around 0 mm/day would not report pain reduction with only NSAIDs. Various therapeutic interventions should be planned for such patients as early as possible to prevent progression to chronic LBP.

References


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