The Effect of Antidepressant Treatment on Chronic Back Pain

A Meta-analysis

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Background: Back pain is one of the most common problems in primary care. Antidepressant medication is often prescribed, especially for chronic back discomfort, to alleviate pain and restore the patient’s ability to conduct activities of daily living.

Objective: To assess the efficacy of antidepressants in treating back pain in adults.

Methods: We searched the MEDLINE (1966–2000), PsycLit, CINHAL, EMBASE, AIDSLINE, HealthSTAR, CANCERLIT, the Cochrane Library (clinical trials registry and the Database of Systematic Reviews), Micromedx, and Federal Research in Progress databases and references of reviewed articles. Included articles were written in English and dealt with randomized placebo-controlled trials of antidepressant medication use among adults with chronic back pain. Two reviewers abstracted data independently. Two continuous outcomes, change in back pain severity and ability to perform activities of daily living, were measured. Study quality was assessed with the methods used by Jadad and colleagues, and data were synthesized using a random-effects model.

Results: Nine randomized controlled trials with 10 treatment arms and 504 patients were included. Seven treatment arms included patients with major depression. Patients had chronic back pain, averaging 10.4 years. Patients treated with antidepressants were more likely to improve in pain severity than those taking placebo (standardized mean difference, 0.41; 95% confidence interval, 0.22–0.61) but not in activities of daily living (standardized mean difference, 0.24; 95% confidence interval, –0.21–0.69). Patients treated with antidepressants experienced more adverse effects (22% vs 14%, P = .01) than those receiving placebo.

Conclusion: Antidepressants are more effective than placebo in reducing pain severity but not functional status in chronic back pain.

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conflicting literature, there is evidence that physicians do prescribe antidepressants for patients with back pain. Primary care physicians prescribe antidepressants in the setting of back discomfort at 2% to 23% of visits. Because the use of antidepressants in back pain therapy remains controversial, we conducted a meta-analysis of the English-language literature.

**METHODS**

For this review, we searched MEDLINE (1966-August 2000), PsycLit (1987-August 2000), Cinhal (1982-2000), EMBASE (1974-August 2000), AIDSLINE, HealthSTAR, CancerLIT, and Micromedex using antidepressants as the text word and keyword (all languages). An additional search was performed using the medical subject heading term antidepressive agents combined with the text words back pain, low back pain, pain, spasm, and clinical trial. We used the Cochrane Library, searching the clinical trials registry for randomized trials, and the Cochrane Database of Systematic Reviews for systematic reviews. A search of the Federal Research in Progress database was conducted to identify unpublished literature. We also searched the references of reviewed articles for additional articles missed by the computerized database search. Studies were screened for inclusion through review of the abstract or the published article if the abstract was unclear. We included articles that had the following characteristics: patients having low back discomfort for 2 or more months, randomization, placebo control, at least one group receiving an antidepressant medication, and measurable outcomes reported.

Included study quality was assessed using a 6-item instrument developed and validated by Jadad et al. The 6 items in this scale include (1) description of randomization, (2) adequacy of blinding, (3) description of withdrawals and dropouts, (4) appropriateness of statistical analysis, (5) description of inclusion and exclusion criteria, and (6) method for assessing adverse treatment effects. Two reviewers (S.M.S. and J.L.J.) assessed study quality independently with substantial interrater agreement ($k = 0.89$). Disagreements were arbitrated by consensus.

Abstracted data included setting, country of origin, treatment characteristics (dose, duration, follow-up), demographics, number of patients enrolled, follow-up losses, adverse effects, and outcomes. Outcomes were extracted as either dichotomous or continuous variables (or both), depending on how they were reported in the studies.

All analyses were performed using Stata statistical software (version 7.0; Stata Corp, College Station, Tex). Assessment for publication bias was performed using the methods of Egger et al, and heterogeneity was assessed visually with Galbraith plots and $Q (\chi^2)$ statistics using the methods of Mantel-Haenszel. The random-effects model of DerSimonian and Laird was used to calculate summary standardized mean differences. Analysis of outcomes involved comparing standardized differences in means between control and treatment groups. Mean outcome scores for the 2 major outcomes of pain severity and activities of daily living for the placebo and treatment groups were standardized by dividing the scores by their SD. The difference between these standardized outcome scores was calculated for each study and analyzed. This approach is especially appropriate when studies measure the same concept but use a variety of continuous scales. By standardization, the study results were transformed to a common scale (SD units) that facilitates pooling. This method of evaluating outcomes is also known as effect size. An effect size of 0.2 is considered small, 0.5 is moderate, and greater than 0.8 is large.

Several measures of the sensitivity of the meta-analysis results to various assumptions were conducted. We tested the relative influence of each individual study on our results by sequentially dropping individual treatment arms and calculating summary measures. We also explored several sources of heterogeneity, including year and country of publication, study quality scores, and antidepressant type using meta-regression.

**RESULTS**

Our literature search produced 315 articles, 23 of which seemed to be potential candidates for inclusion in the analysis. Of these 23, a total of 13 were excluded. Four were excluded because they were written in languages other than English. Three were review articles, and 3 were case reports. One article did not report the level of baseline patient pain or the number of subjects in the treatment and placebo arms. A final article was excluded because it dealt exclusively with patients with acute back pain and used an active acetaminophen arm rather than a control. Of the 10 articles that met inclusion criteria, 2 duplicated results from a single trial, producing a final number of 9 studies (Table 1). One study included 2 active treatment arms, which were considered separately during the analysis.

The 9 randomized controlled trials were of moderate quality, with a mean±SD quality score of 5.1±2.2 (median, 6; range, 2-8). Although all studies were randomized and placebo controlled, there were a number of specific quality problems, including inadequate description of the method of randomization in 4 incomplete description of blinding techniques in 2, excessive (>10%) withdrawal of participants in 4, no intention-to-treat analysis in 5, and no sample size calculations in most. None of the studies directly tested patients for the effectiveness of blinding, but 7 of the studies had more adverse effects in the treatment than placebo groups, suggesting failure to maintain blinding (Table 2). Three studies had negligible descriptions of adverse events.

Multiple types and doses of antidepressants were used in the reviewed studies. Only 2 studies used newer selective serotonin reuptake inhibitors. The remainder used older heterocyclic or tricyclic compounds. Some studies used antidepressants with serotonergic properties such as trazodone, whereas other articles used compounds with
mostly noradrenergic properties such as nortriptyline or maprotiline. Some trials used antidepressants with mixed properties such as doxepin, amitriptyline, and imipramine. The doses of antidepressants varied, but all studies used therapeutic doses typically effective in treating depression. All studies used antidepressants as adjunct therapy and allowed patients to continue using other analgesics. Study duration ranged from 4 to 8 weeks, with an average length of 6.8 weeks.

All studies included patients with chronic low back pain, although one study included patients with cervical back pain, and another study included some patients with acute back pain. The definition of chronic pain varied widely, with most studies defining chronic as pain lasting longer than 6 months. Two used more lenient inclusion criteria of roughly 2 or 3 months, required pain lasting for more than a year, and did not specify a definition of chronic pain. The average duration of chronic pain for participants was 6 months, with no current pain lasting for more than 2 or 3 months.

### Table 1. Characteristics of Included Studies

<table>
<thead>
<tr>
<th>Source, y (Country)</th>
<th>Syndrome and Comments</th>
<th>Drug Dosage</th>
<th>Trial Length, wk</th>
<th>Quality Score (0-8)</th>
<th>Quality Problems*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dickens et al, 2000 (England)</td>
<td>Low back pain &gt;6 months, coexisting clinical depression, patient- and physician-rated outcomes</td>
<td>Paroxetine, 20 mg/d (n = 44), vs placebo (n = 48)</td>
<td>8</td>
<td>7</td>
<td>Inadequate discussion of adverse events</td>
</tr>
<tr>
<td>Atkinson et al, 1999 (United States)</td>
<td>Chronic daily low back pain &gt;6 months, no current mood disorder, patient- and physician-rated outcomes</td>
<td>Maprotiline, 150 mg every night (n = 33), vs paroxetine, 30 mg every night (n = 40), vs active placebo vs diphenhydramine, 37.5 mg every night (n = 36)</td>
<td>8</td>
<td>8</td>
<td>Inadequate description of randomization, no sample size calculations, &gt;10% withdrawals, no intention-to-treat analysis</td>
</tr>
<tr>
<td>Atkinson et al, 1998 (United States)</td>
<td>Chronic daily low back pain &gt;6 months, no current mood disorder, patient- and physician-rated outcomes</td>
<td>Nortriptyline, 100 mg every night (n = 38), vs placebo (n = 40)</td>
<td>8</td>
<td>8</td>
<td>Inadequate description of randomization, randomization, no sample size calculations, unknown number of patients in desipramine and doxepin arms, inadequate description of withdrawals and side effects, no intention-to-treat analysis</td>
</tr>
<tr>
<td>Goodkin et al, 1990 (United States)</td>
<td>Chronic low back pain &gt;12 months, patients with and without depression, patient- and physician-rated outcomes</td>
<td>Trazodone, 100 mg 4 times daily (n = 22), vs placebo (n = 20)</td>
<td>6</td>
<td>6</td>
<td>Inadequate description of randomization, no sample size calculations, &gt;10% withdrawals, no intention-to-treat analysis</td>
</tr>
<tr>
<td>Hameroff et al, 1984 (United States)</td>
<td>Chronic cervical and/or lumbar spine pain &gt;2 months, coexisting clinical depression, patient-rated outcomes</td>
<td>Doxepin, 300 mg every night (n = 30), vs placebo (n = 30)</td>
<td>6</td>
<td>3</td>
<td>Inadequate description of randomization, no sample size calculations, blinded procedure not fully described, inadequate discussion of adverse events, no intention-to-treat analysis</td>
</tr>
<tr>
<td>Ward et al, 1984 (United States)</td>
<td>Chronic low back pain &gt;6 months, patients with depression, physician- and patient-rated outcomes</td>
<td>Desipramine, 3 mg/kg, vs doxepin, 3 mg/kg, vs placebo (n = 26); pre-post study with desipramine and doxepin patients compared with placebo run-in</td>
<td>4</td>
<td>2</td>
<td>Inadequate description of randomization, randomization, no sample size calculations, known number of patients in desipramine and doxepin arms, inadequate description of withdrawals and side effects, no intention-to-treat analysis</td>
</tr>
<tr>
<td>Alcoff et al, 1982 (United States)</td>
<td>Chronic low back pain &gt;6 weeks, patients with and without depression, physician- and patient-rated findings</td>
<td>Oral imipramine, 150 mg every night (n = 28), vs placebo (n = 22)</td>
<td>8</td>
<td>6</td>
<td>No sample size calculations, &gt;10% withdrawals, no intention-to-treat analysis, P-values given without complete outcomes measures</td>
</tr>
<tr>
<td>Pheasant et al, 1983 (United States)</td>
<td>Chronic low back pain &gt;1 year, patients with depression, physician- and patient-rated outcomes</td>
<td>Oral amitriptyline, 150 mg every night, vs atropine, 0.2 mg (n = 9, randomized, blind crossover study)</td>
<td>6</td>
<td>4</td>
<td>Inadequate description of randomization, no sample size calculations, &gt;10% withdrawals, no intention-to-treat analysis</td>
</tr>
<tr>
<td>Jenkins et al, 1976 (England)</td>
<td>Acute and chronic low back pain, patients with and without depression, physician- and patient-rated outcomes</td>
<td>Oral imipramine, 25 mg 3 times daily (n = 23), vs placebo (n = 21)</td>
<td>4</td>
<td>3</td>
<td>Inadequate description of randomization, no sample size calculations, blinded procedure not fully described, &gt;10% withdrawals, no intention-to-treat analysis</td>
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*Ellipses indicate not applicable.*
Objective: Antidepressants may ameliorate chronic pain. We conducted a systematic review and meta-analysis to determine the efficacy of antidepressants in reducing chronic pain.

Methods: We searched PubMed for double-blind, randomized controlled trials comparing antidepressants to placebo in patients with chronic pain. Studies were screened for inclusion and outcome data abstracted for 2 continuous variables: pain severity and effect on activities of daily living. Pain severity was assessed in all studies using 4 methods: visual analog scale, numerical pain descriptor, Oswestry Disability Index, and Clinical Global Assessment Scale. Activities of daily living were assessed using 3 methods: Disability of the Arm, Shoulder and Hand Scale, Impact Profile, and Short-Form-36. Data were analyzed using a random-effects model for the standardized mean difference and a fixed-effects model for the rate difference.

Results: Seventy-one trials (25,194 patients) were included. Antidepressants reduced chronic pain severity by 0.13 (95% confidence interval [CI], −0.21 to 0.69) in the standardized mean difference for patients treated with antidepressants compared with placebo. The rate difference favored treatment by 0.04 (95% CI, −0.05 to 0.13). There was no evidence of publication bias (Egger test, P = .32). There was no statistical evidence of significant effect size heterogeneity (χ² = 10.47, P = .32). Despite the lack of statistical heterogeneity, we still used a random-effects model because of the clinical diversity of antidepressants used and variation of inclusion criteria among the studies. There was no evidence of publication bias (Egger test, P = .90).

Sensitivity analysis was performed to assess the effect of study quality, year of publication, country of publication, duration of treatment, and type of antidepressant. We also explored the effect of dropping individual studies from our meta-analysis. None of the parameters included in our sensitivity analysis significantly changed our results.

All of our studies had extractable continuous data, but we were unable to extract any consistent dichotomous outcomes. All of the outcomes were patient rated. Data were abstracted for 2 continuous variables: pain severity and effect on activities of daily living (Table 3). Pain severity was assessed in all studies. For pain assessment, 4 studies used simple visual analog scales, with scores varying from 10 to 100 points. Other reasons cited for exclusion were urinary retention or renal disease, glaucoma, pregnancy, chronic obstructive pulmonary disease, and a history of substance abuse. One study mentioned no specific exclusion criteria.

Conclusion: Antidepressants may have a small but significant effect when compared with placebo in reducing chronic back pain. A similar small but nonsignificant trend in improving function in activities of daily living was noted. There are several theoretical reasons why antidepressants might benefit patients with back discomfort. Antidepressants may ameliorate the patient’s perception of pain by treating the underlying depres-
Some authors hypothesize that there are similarities between neurotransmitter systems involved in depression and pain and that there are beneficial effects on pain separate from antidepressant effects. There is evidence that antidepressant therapy has significant benefits in other chronic pain syndromes such as fibromyalgia, irritable bowel disease, and migraine headaches. In fact, the 1997 guideline by the American Society of Anesthesiologists for the treatment of chronic pain recommends antidepressants as adjunct therapy for chronic pain syndromes.

The benefits of the small improvement in back pain severity must be weighed against the considerable amount of adverse effects observed. More than a fifth of patients undergoing antidepressant therapy experienced adverse reactions, compared with 14% of controls. Because adverse reactions were poorly reported in several studies, this likely underestimates the degree to which they occurred. The high doses of antidepressants used may explain the high incidence of adverse reactions. The most common adverse reactions included drowsiness, dry mouth, dizziness, and constipation.

There are a number of important limitations to our findings. First, nearly all the studies in our meta-analysis were underpowered, and the advantages to antidepressant therapy may be greater than stated. Although our meta-analysis comprised nearly 30 years of research, there were only 287 patients studied in the active treatment groups and 252 in the control groups. Our meta-analysis may not have been sufficiently powered to demonstrate a difference in activities of daily living. With only 5 studies measuring this outcome, our power was only 0.63 to show this degree of difference. Thus, it is possible that at least a modest effect on patient’s activities of daily living was missed. Second, our study cannot draw conclusions about antidepressants in the therapy of acute back pain. It is possible that antidepressant therapy may be useful in this setting. One trial testing amitriptyline against acetaminophen found amitriptyline to be the superior therapy. Cyclobenzaprine, a skeletal muscle relaxant, has also recently been shown to be effective therapy for acute back pain. The chemical structure of cyclobenzaprine differs from tricyclic antidepressants by only one hetero- phile bond, which may explain why antidepressants could be effective in the short-term setting. Third, it is difficult to make a firm conclusion on whether antidepressant therapy will be effective in the treatment of low back pain in patients without depression. Only 2 studies specifically excluded patients with depression, making our analysis inappropriate to answer this question with certainty. However, both studies demonstrated a benefit in pain reduction using tricyclic antidepressants, and one showed no benefit with selective serotonin reuptake inhibitors. These results are similar to studies that include patients with depression. Few studies collected information on workers’ compensation or litigation. One of the most important predictors of recovery from chronic back pain is lack of involvement in these processes. Given the chronic nature of these patients’ symptoms, it is possible that many were involved in either workers’ compensation or litigation, which would have confounded our results. Finally, many studies were of relatively low quality, most measured few outcomes, and some used poorly validated instruments to assess functional status or pain. Better-quality studies using standardized, validated instruments are needed.

In conclusion, adjunct antidepressant therapy at doses therapeutic for depression is associated with a small but significant reduction in the severity of chronic back pain but not improvement in activities of daily living. Antidepressant therapy was associated with significantly more adverse effects than placebo. Larger, better-designed randomized control trials that weigh the benefits and adverse effects of antidepressant therapy are needed before the use of antidepressants can be routinely recommended as therapy for back pain in patients without depression.

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The opinions or assertions contained herein are the private views of the authors and are not to be construed as official or as reflecting those of the US Department of the Army, the US Department of the Navy, or the US Department of Defense.

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