Objective: The purpose of this study was to critically appraise and synthesize evidence on the effectiveness of noninvasive interventions, excluding pharmacological treatments, for musculoskeletal thoracic pain.

Methods: Randomized controlled trials (RCTs), cohort studies, and case-control studies evaluating the effectiveness of noninvasive interventions were eligible. We searched MEDLINE, EMBASE, PsycINFO, and the Cochrane Central Register of Controlled Trials accessed through Ovid Technologies, Inc, and CINAHL Plus with Full Text accessed through EBSCOhost from 1990 to 2015. Our search strategies combined controlled vocabulary relevant to each database (eg, MeSH for MEDLINE) and text words relevant to our research question and the inclusion criteria. Random pairs of independent reviewers screened studies for relevance and critically appraised relevant studies using the Scottish Intercollegiate Guidelines Network criteria. Studies with a low risk of bias were synthesized following best evidence synthesis principles.
In 2008, the 2000-2010 Bone and Joint Decade Task Force on Neck Pain and Its Associated Disorders synthesized the evidence on the management of neck pain and associated disorders. One of the associated disorders identified by the Bone and Joint Decade Task Force on Neck Pain and Its Associated Disorders was thoracic pain. This work built on the systematic review in 1995 from the Quebec Task Force on Whiplash Associated Disorders, which included thoracic pain among the cluster of symptoms associated with whiplash-associated disorders. Thoracic pain includes musculoskeletal pain related to the thoracic spine and chest. Thoracic pain is commonly associated with neck pain in individuals injured in traffic collisions. Data from a Saskatchewan population-based cohort study suggest that 65.5% and 18.9% of individuals injured in traffic collisions report mid-back and anterior chest wall pain, respectively. Moreover, 46.3% reported a combination of pain in the neck, head, shoulder, and mid-back.

Musculoskeletal thoracic pain is common in the general population. The annual prevalence of thoracic spine pain in adults ranges from 15.0% in Swedish adults (aged 35-45 years) to 34.8% in Swedish working adults (aged 16-65 years). Thoracic spine pain can also be a cause of anterior chest wall pain. In Danish twins, the annual prevalence of mid-back pain is 13%, and 5% report associated radiating chest wall pain. Among adults with noncardiac chest wall pain admitted to a hospital in the United Kingdom, thoracic spinal structures were the primary cause of pain in 14% of cases. Furthermore, among chest pain cases presenting to primary care in Iceland, 49.6% were attributed to musculoskeletal causes including intercostal myalgia and sprains within the thoracic cage.

To our knowledge, no prospective studies have addressed the course and prognosis of thoracic spine pain. However, a cross-sectional study from Finland found that 23.5% of adults with mid-back pain reported difficulties with normal activities due to pain, suggesting a potential impact on disability. Studies on the management of noncardiac chest pain (including musculoskeletal chest wall pain) suggest that recurrent episodes are common. Among those diagnosed with noncardiac chest pain in an Australian emergency department (56% of whom had musculoskeletal chest wall pain), 90% reported continued chest pain at 2-year follow-up. Care seeking due to noncardiac chest pain was self-reported by 36% of patients.

There is a lack of evidence to guide the management of musculoskeletal thoracic pain. In 2003, the Australian Acute Musculoskeletal Pain Guidelines Group recommended spinal manipulation for the management of acute thoracic spine pain. This recommendation was based on 1 small trial with important methodological limitations. No recommendations could be made on the use of education, exercise, soft tissue therapy, passive physical modalities, acupuncture, work disability prevention interventions, or multimodal interventions. In 2007, a systematic review on manual therapy for thoracic spine pain concluded that manual therapy was effective. However, this conclusion was based on the same trial with important methodological limitations.

The objective of this systematic review is to determine the effectiveness of noninvasive interventions (excluding pharmacological treatments) for the management of musculoskeletal thoracic pain (ie, musculoskeletal thoracic spine or chest wall pain).

**METHODS**

**Registration**

This systematic review combines 2 separate protocols registered with the International Prospective Register of Systematic Reviews (PROSPERO). The first review protocol (manual and soft tissue therapies) was registered on May 28, 2013 (CRD42013004686), and the second...
one (other noninvasive interventions) was registered on December 2, 2013 (CRD42013006580).

Eligibility Criteria

Population. Our review targeted studies of adults or children with musculoskeletal thoracic pain (ie, musculoskeletal thoracic spine or chest wall pain). We excluded studies of severe injuries including spinal cord injuries, vertebral fractures/dislocations, infection, neoplasm, inflammatory disorders, and visceral pain referred from abdominal or thoracic organs to the chest wall (eg, myocardial ischemia, dissecting thoracic aortic aneurysm, peptic ulcer, and acute cholecystitis and pancreatitis). We defined thoracic spine pain according to the International Association for the Study of Pain: pain reported within the region bounded superiorly by the first thoracic spinous process, inferiorly by the last thoracic spinous process, and by the most lateral margins of the erector spinae muscles. Musculoskeletal chest wall pain refers to pain of musculoskeletal origin reported in the anterior and posterolateral chest wall (region bounded superiorly by the thoracic outlet, inferiorly by the diaphragmatic margin, and lateral to the most lateral margins of the erector spinae muscles). Structures causing pain in this area may include intervertebral joints, costovertebral joints, sternocostal joints, costochondral joints, or corresponding musculature of the thoracic cage. Musculoskeletal thoracic pain occurs in the absence of significant pathologies such as infection, neoplasm, metastasis, osteoporosis, inflammatory arthropathies, fractures, or referral from abdominal or thoracic viscera (eg, myocardial ischemia and angina pectoris).

Interventions. Noninvasive interventions include any form of treatment considered to be noninvasive or minimally invasive (ie, penetrating needle acupuncture) and involve any nonsurgical treatment options. We restricted our review to common noninvasive interventions in clinical practice. These include manual therapy (ie, manipulation, mobilization, and traction), soft tissue therapy, exercise, patient education, acupuncture (in any form), passive physical modalities (ie, physical modalities and assistive devices), work disability prevention interventions, and multimodal treatment. We excluded pharmacological treatments.

Comparison Groups. We included studies that compared 2 or more noninvasive interventions or 1 noninvasive intervention to a placebo/sham intervention, wait list, or no intervention.

Outcomes

To be eligible, studies had to include one of the following outcomes: (1) self-rated recovery, (2) functional recovery (eg, disability, return to activities, work, or school), (3) pain intensity, (4) health-related quality of life, (5) psychological outcomes such as depression or fear, or (6) adverse events.

Study Characteristics. Eligible studies met the following criteria: (1) English language; (2) studies published between January 1, 1990, and March 16, 2015, for manual therapy and soft tissue therapy and between January 1, 1990, and March 7, 2015, for all other noninvasive interventions; (3) RCTs, cohort studies, or case-control studies, which are designed to assess the effectiveness and safety of interventions; (4) included an inception cohort of a minimum of 30 participants per treatment arm with the specified condition for RCTs or 100 participants per group with the specified condition in cohort studies or case-control studies. In RCTs, a sample size of 30 per arm is conventionally considered the minimum needed for nonnormal distributions to approximate the normal distribution. The assumption that data are normally distributed is required to ascertain a difference in sample means between treatment arms.

We excluded studies with the following characteristics: (1) letters, editorials, commentaries, unpublished manuscripts, dissertations, government reports, books and book chapters, conference proceedings, meeting abstracts, lectures and addresses, consensus development statements, or guideline statements; (2) pilot studies, cross-sectional studies, case reports, case series, qualitative studies, narrative reviews, systematic reviews, clinical practice guidelines, biomechanical studies, or laboratory studies; or (3) cadaveric or animal studies.

Information Sources

We developed our search strategies with a health sciences librarian (Appendix I and Appendix II). A second librarian reviewed the search strategies for completeness and accuracy using the Peer Review of Electronic Search Strategies Checklist. We searched MEDLINE and EMBASE, considered to be the major biomedical databases, and PsycINFO for psychological literature through Ovid Technologies, Inc; CINAHL Plus with Full Text for nursing and allied health literature through EBSCOhost; and the Cochrane Central Register of Controlled Trials for any studies not captured by the other databases through Ovid Technologies, Inc. Our search strategies combined controlled vocabulary relevant to each database (eg, MeSH for MEDLINE) and text words relevant to our research question and the inclusion criteria. We conducted our search from January 1990 to March 2015. As a supplemental search, we hand searched the reference lists of previous systematic reviews for any additional relevant studies. We used EndNote X6 to create a bibliographic database to manage the search results.
Study Selection

We used a 2-phase screening process to select eligible studies. In phase 1, random pairs of independent reviewers screened citation titles and abstracts to determine the eligibility of studies. Phase 1 screening resulted in studies being classified as relevant, possibly relevant, or irrelevant. In phase 2, the same pairs of reviewers independently screened the possibly relevant studies to determine eligibility. Reviewers met to resolve disagreements and reach consensus on the eligibility of studies. We involved a third reviewer if consensus could not be reached.

Assessment of Risk of Bias

Random pairs of independent reviewers critically appraised the internal validity of eligible studies using the Scottish Intercollegiate Guidelines Network (SIGN) criteria. The SIGN criteria were used to qualitatively evaluate the presence and impact of selection bias, information bias, and confounding on the results of a study. We did not use a quantitative score or a cut-off point to determine the internal validity of studies. Rather, the SIGN criteria were used to assist reviewers make an informed overall judgment on the internal validity of studies. This methodology has been previously described.

Specifically, we critically appraised the following methodological aspects of a study: (1) clarity of the research question, (2) randomization method, (3) concealment of treatment allocation, (4) blinding of treatment and outcomes, (5) similarity of baseline characteristics between/among treatment arms, (6) cointervention contamination, (7) validity and reliability of outcome measures, (8) follow-up rates, (9) analysis according to intention-to-treat (ITT) principles, and (10) comparability of results across study sites (where applicable). Reviewers reached consensus through discussion. An independent third reviewer resolved disagreements if consensus could not be reached. We contacted authors when we required additional information to complete the critical appraisal. Studies with adequate internal validity had a low risk of bias and were included in our evidence synthesis.

Data Extraction and Synthesis of Results

We computed agreement between reviewers for the screening of articles and reported the $\kappa$ statistic and 95% confidence interval (CI). When available, we used data provided in the studies with a low risk of bias to measure the association between the tested interventions and the outcomes by computing the relative risk (RR) and its
95% CI. Similarly, we computed differences in mean changes between groups and 95% CI to quantify the effectiveness of interventions. The computation of 95% CIs was based on the assumption that baseline and follow-up outcomes were highly correlated ($r = 0.80$).31,32

The lead author extracted data from studies with a low risk of bias. A second reviewer independently checked the extracted data. Meta-analysis was not performed because the studies were heterogeneous with respect to patient populations, interventions, comparators, and outcomes. We performed a qualitative synthesis of findings from studies with a low risk of bias to develop evidence statements according to principles of best evidence synthesis.29 We used standardized cut-off values where available to determine if clinically important changes were reached in each trial for common outcome measures. These include a between-group 2/10 difference on the Numeric Rating Scale (NRS)33 and 10/100 mm or 10% difference on the visual analog scale (VAS).34 We stratified our results according to condition (musculoskeletal thoracic spine pain vs musculoskeletal chest wall pain).

**Reporting**

The systematic review was organized and reported based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses statement.35

**RESULTS**

**Study Selection**

Our search for manual therapy and soft tissue therapy retrieved 778 articles. We removed 72 duplicates and screened 706 articles for eligibility (Fig 1A). After screening, 705 articles did not meet our selection criteria, whereas only 1 study was relevant.36 The interrater agreement for the screening of articles was $k = 0.665$ (95% CI, 0.229-1.000; n = 706). The search for other noninvasive interventions retrieved 7486 articles. We removed 1204 duplicates and screened 6282 articles for eligibility (Fig 1B). After screening, 6279 articles did not meet our selection criteria, whereas 3 articles were found to be relevant. The interrater agreement for the screening of articles was $k = 1.000$ (n = 6282). Among the 3 relevant articles retrieved in our search for all other noninvasive interventions, 1 was a duplicate of the article retrieved in our search for manual and soft tissue therapies.36 The 2 remaining articles reported on short- and long-term follow-up results from 1 study.37,38 Therefore, we critically appraised 2 studies reported in 3 articles, and both had a low risk of bias.36–38

**Study Characteristics**

Both studies with a low risk of bias were RCTs. One compared the effectiveness of thoracic spinal manipulation,
<table>
<thead>
<tr>
<th>Author(s), Year</th>
<th>Subjects and Setting; Number (n) Enrolled</th>
<th>Interventions; No. of Subjects</th>
<th>Comparisons; No. of Subjects</th>
<th>Follow-Up</th>
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<tbody>
<tr>
<td>Lehtola et al, 2010</td>
<td>Females (20-60 years old) referred for physiotherapy by general practitioners or occupational health staff for thoracic pain; n = 114</td>
<td>Manipulation: 4 × 3 wk by a physiotherapist; high-velocity thrust between T3 and T8; n = 39</td>
<td>Placebo: 4 × 3 wk by a physiotherapist; deactivated interference—electrotherapy with intermittent suction; n = 38</td>
<td>1 wk postintervention</td>
<td>Primary outcome: Pain (VAS) Secondary outcomes: PPT (pressure algometer, average of 3 different measurements, satisfaction [3-point global impression of change])</td>
<td>Difference in mean change(^b) (manipulation − placebo): VAS (10 cm), 0.9 (95% CI, 0.3 to 1.5); PPT (kg/cm(^2)), −1.3 (95% CI, −2.1 to −0.4) Difference in mean change(^b) (acupuncture − placebo): VAS (10 cm), 0 (95% CI, −0.5 to 0.5); PPT (kg/cm(^2)), 0.6 (95% CI, −0.2 to 1.4) Difference in mean change(^b) (manipulation − acupuncture): VAS (cm), 0.9 (95% CI, 0.3-1.5); PPT (kg/cm(^2)), 0.7 (95% CI, −0.1 to 1.5)</td>
</tr>
<tr>
<td>Stockkendahl et al, 2012(^{26})/Stockkendahl et al, 2012(^{27})</td>
<td>Patients 18-75 years old presenting to an emergency cardiology department in Denmark with acute chest pain. Case definition: Pain &lt;7-d duration, discharged from emergency department without a diagnosis of acute coronary syndrome or other definite cardiac or medical diagnosis, positive diagnosis of musculoskeletal chest pain.</td>
<td>Multimodal program of care provided by a chiropractor (up to 10 visits/4 wk) including HVLA manipulation to cervical and/or thoracic spine, combined with any or all of the following: joint mobilization, soft tissue therapy, stretching, stabilizing or strengthening exercises, heat or cold, and advice; n = 59</td>
<td>Single session of education provided by a chiropractor: 15-min consultation: reassurance and advice promoting self-management and individualized instruction on posture and home exercises to increase spinal movement or muscle stretch; n = 56</td>
<td>4 (immediately postintervention), 12, 52 wk</td>
<td>Primary outcomes: Worst chest pain (NRS) and self-perceived change in chest pain (7-point ordinal scale). Secondary outcomes: Health-related quality of life (SF-36); chest pain now, average chest pain, thoracic spine pain, neck pain, shoulder-arm pain; self-perceived change in general health (7-point ordinal scale); self-perceived treatment effect (4-point ordinal scale); work absenteeism (yes/no, days); limitations in activities of daily living (yes/no); use of over-the-counter medication (yes/no, costs); use of health care providers (yes/no, visits). Adverse events.</td>
<td>(^a) No differences in the proportion of participants experiencing improvement(^a) in worst chest pain, chest pain now, chest pain average, thoracic spine pain, neck pain, or shoulder-arm pain. (^b) Multimodal care vs education: RR, 1.4 (95% CI, 1.1-1.8) (^\circ) General health reported as better or much better Multimodal care vs education: RR, 2.2 (95% CI, 1.4-3.4) (^\circ) No differences in mean change for worst chest pain, chest pain now, average chest pain, thoracic spine pain, neck pain, or shoulder-arm pain (^\circ) Multimodal care vs education: RR, 0.8 (95% CI, 0.2-2.0)</td>
</tr>
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shoulder-arm pain.
Chest pain reported as better or much better
Multimodal care vs education: RR, 1.4 (95% CI, 1.0-1.9)  
General health reported as better or much better
Multimodal care vs education: RR, 1.3 (95% CI, 0.9-1.9)  
No differences in the proportion of participants experiencing improvement in worst chest pain, chest pain now, chest pain average, thoracic spine pain, neck pain, or shoulder-arm pain  
52 wk:
Difference in mean change (multimodal care − education): Worst chest pain (0-10), 0.1 (95% CI, −1.0 to 1.2)  
No differences in mean change for worst chest pain, chest pain now, chest pain average, thoracic spine pain, neck pain, or shoulder-arm pain.  
Chest pain reported as better or much better
Multimodal care vs education: RR, 1.2 (95% CI, 0.9-1.6)  
General health reported as better or much better
Multimodal care vs education: RR, 1.1 (95% CI, 0.7-1.5)  
No differences in the proportion of participants experiencing improvement in worst chest pain, chest pain now, chest pain average, thoracic spine pain, neck pain, or shoulder-arm pain  
No difference between groups for work absenteeism, limitation in activities of daily living, use of over-the-counter medications, or visits to health care providers  
Adverse events: No serious adverse events reported; 75% of participants in the multimodal care group reported transient and benign adverse events.

HVLA, high velocity low amplitude; NRS, numeric rating scale; PPT, pressure pain threshold; RR, relative risk; SF-36, Medical Outcomes Study 36-Item Short Form Health Survey; VAS, visual analog scale; y.o., years old.

Improvement defined as a change from NRS greater than 0 to NRS of 0.
Between-group difference in mean change and 95% CIs calculated by authors based on the assumption that preintervention and postintervention outcomes were highly correlated (r = 0.8).  
Relative risks calculated by authors.
needle acupuncture, and placebo electrotherapy for the treatment of recent-onset thoracic spine pain. The other compared a multimodal program of care provided by a chiropractor (cervical and thoracic spinal manipulation, mobilization, soft tissue therapy, ice/heat, advice, and exercise) and single education session provided by a chiropractor (reassurance, advice, and home exercises) for the management of recent-onset musculoskeletal chest wall pain.37,38

Risk of Bias Within Studies
Both studies with a low risk of bias used appropriate methods of randomization and allocation concealment (Table 1). One study37,38 used appropriate blinding procedures where possible. Both studies achieved similarity at baseline between treatment arms. The follow-up rate was more than 70% in both studies. The study by Lehtola et al36 used the same treatment provider across all 3 groups, which could have led to potential bias in the administration of the treatments. The same study36 did not report on cointerventions; however, as the duration of the treatment was short and there was no long-term follow-up, the impact of this potential bias on the results is expected to be low. Finally, this study did not report conducting an ITT analysis.36 However, as there was no cross-over in this study and the drop-out rate was negligible in all treatment arms, an ITT analysis is not likely to change the results.

Summary of Evidence
Recent-Onset Thoracic Spine Pain. Evidence from 1 RCT suggests that thoracic spinal manipulation and needle acupuncture lead to similar outcomes as placebo electrotherapy in reducing pain in female patients with recent-onset mechanical thoracic spinal pain36 (Table 2). Lehtola et al randomized females with thoracic spine pain (≤ 3-month duration) between the third and eighth thoracic vertebrae to receive (1) high-velocity thrust spinal manipulation, (2) needle acupuncture, or (3) placebo electrotherapy with intermittent suction. All interventions were provided by the same physiotherapist 4 times per week for 3 weeks.36 There were small statistically significant differences in pain reduction favoring manipulation 1-week postintervention. However, these differences were not clinically important (difference in mean pain change: manipulation vs placebo 0.9 cm [95% CI, 0.3-1.5]; manipulation vs acupuncture 0.9 cm [95% CI, 0.3-1.5]). There were no differences between acupuncture and placebo (Table 2).

Recent-Onset Musculoskeletal Chest Wall Pain. Evidence from 1 RCT suggests that a multimodal program of care and a single session of education provided by a chiropractor lead to similar clinical outcomes for the management of recent-onset musculoskeletal chest wall pain37,38 (Table 2). However, those who received multimodal care were more likely to report self-reported improvement. Stochkendahl et al37,38 randomized participants with recent-onset (<7 days) anterior chest wall pain to receive a multimodal program of care (10 visits/4 weeks of cervical and/or thoracic spinal manipulation, mobilization, soft tissue therapy, exercises, heat/ice, and advice) or a single consultation with a chiropractor consisting of reassurance, advice, and home exercises. The authors reported a statistically significant improvement in “worst chest pain” reduction favoring the multimodal care group at the 12-week follow-up but not at 4- and 52-week follow-ups. However, this difference was not clinically important (difference in mean change from baseline: NRS [0-10], 1.1 [95% CI 0.2-2.0]). There were no other statistically significant differences in pain reduction between groups at 4-, 12-, or 52-week follow-up. Participants who received multimodal care were more likely to report that their chest wall pain was “better” or “much better” at 4 weeks (RR, 1.4 [95% CI, 1.1-1.8]) and 12 weeks (RR, 1.4 [95% CI, 1.0-1.9]). Similarly, participants in the multimodal care group were more likely to report their general health to be “better” or “much better” at 4 weeks (RR, 2.2 [95% CI, 1.4-3.4]) (Table 2). No differences between groups were reported for work absenteeism, difficulties with activities of daily living, medication use, and additional health care use at any of the follow-up points (Table 2).

Adverse Events. One study reported on adverse events.37,38 Stochkendahl et al37,38 reported no serious adverse events in the multimodal care group. However, 75% of participants in this group reported transient and benign adverse events such as local tenderness, headache, and fatigue.

DISCUSSION

Summary of Evidence
Few high-quality studies are available to inform the management of musculoskeletal thoracic pain. We accepted 2 studies with a low risk of bias that investigated the effectiveness of noninvasive interventions for the management of musculoskeletal thoracic pain. We found evidence that manipulation may lead to a small and clinically nonimportant reduction in pain intensity compared to placebo and acupuncture. This evidence suggests that thoracic spinal manipulation and acupuncture may not be associated with meaningful improvement in musculoskeletal thoracic pain.36 We found that, for recent-onset musculoskeletal chest wall pain, a multimodal program of care and a single education session (reassurance, advice, and home exercise) lead to similar outcomes with respect to pain reduction. However, patients who received a multimodal program of care were 40% more likely to report clinically important improvement in chest pain.37,38 We did not find evidence concerning the management of persistent musculoskeletal thoracic pain. The effectiveness of passive modalities, exercise, or soft tissue therapy is not known.
Other Systematic Reviews

Our findings do not support the recommendations from the Australian Acute Musculoskeletal Pain Guidelines Group and the conclusions from a systematic review on the use of spinal manipulation for the management of thoracic spine pain. They concluded that spinal manipulation is effective compared to placebo for thoracic spine pain. These recommendations were based on 1 small randomized trial with several important methodological limitations: (1) methods of randomization and allocation concealment were not described, (2) the baseline characteristics were not balanced, and (3) group-specific loss to follow-up was not presented.

Our review and a recent systematic review by Burgstaller et al included the same trials, but our conclusions do not agree. Based on our methodology, a low risk of bias study suggests that an intervention is effective if the differences in outcomes between the treatment groups are statistically significant and clinically important. However, Burgstaller et al did not take into account the lack of clinically important differences reported by Lehtola et al and concluded that the statistically significant but clinically nonimportant differences supported the effectiveness of manipulation.

Strengths

Our study has strengths. First, we developed a sensitive search strategy, which was checked through peer review. Second, we defined an explicit set of inclusion and exclusion criteria to identify all possibly relevant citations from the searched literature. Third, we used 2 independent reviewers for screening and critical appraisal to minimize error and bias. Fourth, we used a well-accepted and valid set of criteria (SIGN) for critical appraisal. In addition, we performed a best evidence synthesis using only internally valid studies to minimize bias in the reported results. By restricting our synthesis to low risk of bias studies, we limited the impact of bias that would be introduced by synthesizing the results of studies with important methodological limitations. Finally, our methodology was standardized, and all reviewers were trained in critical appraisal before commencement of the systematic review.

Limitations

Our review has limitations. First, we restricted our search to studies published in the English language, which may have resulted in the exclusion of some relevant studies. However, previous reviews have found that the restriction of systematic reviews to English language studies has not led to a bias in reported results. Second, critical appraisal requires scientific judgment, which may vary between reviewers. This potential bias was minimized by training reviewers to use a standardized critical appraisal tool and using a consensus process between reviewers to reach decisions regarding scientific admissibility. Third, our search may not have retrieved all relevant studies, despite our efforts to create a sensitive search strategy.

Future/Recommended Studies

Our systematic review demonstrates that there is a lack of high-quality RCTs to inform the management of recent and persistent musculoskeletal thoracic pain. In consideration of the noted prevalence of musculoskeletal thoracic pain in the population and the frequency of noncardiac chest pain, research is needed to determine the effectiveness of the most common noninvasive interventions including manual therapy. Further research is needed to guide the management of musculoskeletal thoracic pain.

Conclusions

The current evidence on the management of musculoskeletal thoracic pain is limited. The available evidence does not support the effectiveness of acupuncture, spinal manipulation, multimodal care, or a single education session for the management of recent-onset musculoskeletal thoracic pain.

Practical Applications

- The evidence on the management of musculoskeletal thoracic pain is limited.
- The available evidence suggests that acupuncture and spinal manipulation are not effective for the management of recent-onset thoracic spine pain.
- A multimodal program of care and a single education session lead to similar outcomes in terms of pain reduction for the management of recent-onset musculoskeletal chest wall pain.
- Patients who receive a multimodal program of care were more likely to report clinically important improvements in chest pain.

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Contributorship Information


Supervision (provided oversight, responsible for organization and implementation, writing of the manuscript): P.C., L.C.


Analysis/interpretation (responsible for statistical analysis, evaluation, and presentation of the results): Da.S., A.M., P.C., M.S., S.M.

Literature search (performed the literature search): Da.S., P.C., A.T.V.

Writing (responsible for writing a substantive part of the manuscript): Da.S., A.M., P.C.


Appendix A. Supplementary Data

Supplementary data to this article can be found online at http://dx.doi.org/10.1016/j.jmpt.2015.06.001.

References


