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Incidence and risk factors for Modic changes in the lumbar spine: a systematic review and meta-analysis

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Cao, ZY; Zhang, MT; Jia, JW; Zhang, GZ; Li, L; Yang, ZL; Zhang, YZ; Lei, SH; Zheng, F; Kang, XW.

Corresponding author:

Xuwen Kang

ery_kangxw@lzu.edu.cn

Author Affiliation:

The Second Hospital of Lanzhou University.

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Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 26 September 2024 and was last updated on 26 September 2024.

INTRODUCTION

Review question / Objective Modic changes refer to alterations in bone marrow located beneath the vertebral endplates, potentially associated with infections, trauma, disc degeneration, scoliosis, and other pathological conditions. Nonetheless, prior research has not systematically evaluated the incidence of Modic changes as a potential contributor to lower back pain, nor have they fully examined the associated risk factors. This study seeks to systematically analyze and assess the incidence of Modic changes and their associated risk factors in patients with lower back pain.

Condition being studied Modic changes are changes in the bone tissue beneath the vertebral endplates that can be distinguished by MRI. Based on the MRI manifestations, modic changes can be classified into three types: type I is typified by oedema and inflammatory changes in the bone below the endplates; type II is typified by fatty deposits and infiltration of the bone below the endplates; and type III is typified by sclerotic changes in the bone below the endplates locally. There are no systematic meta-analyses of the incidence and risk factors for Modic changes. We conducted a systematic review of the literature using Web of Science, PubMed, Cochrane Library and Embase databases. Eligible studies clearly documented the

incidence of Modic changes and associated risk factors in patients with lower back pain. We extracted and systematically analysed data on the incidence of Modic changes and associated risk factors from the selected studies.

METHODS

Participant or population Participants and patients of all ages with low back pain caused by lumbar degenerative diseases such as lumbar disc herniation, lumbar spondylolisthesis and degenerative lumbar scoliosis, with or without lumbar disc removal or spinal fusion and other surgical treatments.

Intervention The control group was the non-Modic change and the experimental group was the Modic change.

Comparator Age, physical labor, gender, body mass index (BMI), smoking, pfirrmann classification, degenerative disc(s), endplate changes, lumbar lordosis angle, spondylolisthesis, lumbar disc herniation, segmental distribution, and sacral slope angle.

Study designs to be included Prospective, retrospective, cross-sectional and cohort studies.

Eligibility criteria The inclusion criteria were as follows: (1) Participants and patients of all ages presenting with low back pain due to degenerative conditions of the lumbar spine, including lumbar disc herniation, lumbar spondylolisthesis, and degenerative lumbar lateral herniation, with or without lumbar disc removal, spinal fusion, or other surgical interventions; (2) Presence of Modic changes beneath the vertebral endplates confirmed by MRI; and (3) Publications in the English language. The exclusion criteria were as follows: (1) Pregnancy, traumatic fracture, spinal infection or tuberculosis, spinal deformity, malignancy, radiotherapy, recent use of antibiotics or corticosteroids, and psychological or psychiatric disorders; (2) Meta-analyses, case reports, reviews, technical notes, or abstracts only; and (3) Missing clinical data.

Information sources PubMed, Embase, Web of Science and Cochrane Library databases.

Main outcome(s) Modic changes occur in 34% of patients with lower back pain. The principal risk factors for these changes include advanced age, disc degeneration, endplate alterations, elevated Pfirrmann grades, spondylolisthesis, diminished

anterior lumbar lordosis angles, and participation in physical labor.

Quality assessment / Risk of bias analysis A quality assessment study of the entire included literature was conducted using the Newcastle-Ottawa Scale (NOS) as a checklist. Studies were rated for NOS based on patient selection, comparability between groups, and identification of outcomes of interest. Using Review Manager version 5.4 software to assess risk of bias.

Strategy of data synthesis Statistical analyses and graphical representations were generated using Review Manager (RevMan) version 5.4 software. Studies that calculated odds ratios (ORs) were included in the meta-analysis. Heterogeneity was assessed using the I^2 statistic, with slight statistical heterogeneity defined as $I^2 \leq 50\%$. Data were analyzed using a fixed-effects model, or a random-effects model if $I^2 \geq 50\%$. The estimated incidence was calculated as a combined proportion with a 95% confidence interval (CI).

Subgroup analysis We divided into Modic change and non-Modic change groups and analysed them.

Sensitivity analysis Statistical analyses were performed using Review Manager version 5.4 software.

Country(ies) involved China.

Keywords Modic change; Lower back pain; Meta-analysis; Incidence; Risk factor.

Contributions of each author

Author 1 - Zhenyu Cao.
Email: zhenyu841006@163.com
Author 2 - Mingtao Zhang.
Email: mtz1717@163.com
Author 3 - Jingwen Jia.
Email: 220220904251@lzu.edu.cn
Author 4 - Guangzhi Zhang.
Email: zhanggz18@lzu.edu.cn
Author 5 - Lei Li.
Email: lil21@lzu.edu.cn
Author 6 - Zhili Yang.
Email: 220220904381@lzu.edu.cn
Author 7 - Yizhi Zhang.
Email: zhyizhi2023@lzu.edu.cn
Author 8 - Shuanhu Lei.
Email: leishh21@lzu.edu.cn
Author 9 - Feng Zheng.
Email: hydgk2011@163.com
Author 10 - Xuewen Kang.
Email: ery_kangxw@lzu.edu.cn