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Preventing Low Back Pain: Diagnosis of Psychosocial Risk Factors in Athletes (MiSpEx Network)

Prävention unspezifischer Rückenschmerzen: Ein Beitrag zur Diagnostik psychosozialer Risikofaktoren bei Athleten

REVIEW

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Summary

› **Psychosocial risk factors** significantly influence the genesis of chronic non-specific low back pain (CLBP) as one potential factor in its multifactorial etiology. Therefore, the European Guideline for Diagnostics and Therapy of Back Pain recommend screenings for these factors at an early stage of preventive and therapeutic interventions. Relevant risk factors for the development of CLBP in athletes are pain experience and tolerance, stress, social and medical environment. However, as existing screening tools are not suitable for athletes, there is a need for indices that predict the risk of future back complaints and infer a stratified treatment allocation respecting the response to physical activity.

› **The National Research Network** for Medicine in Spine Exercise (MiSpEx) is aiming to fill that gap: a biopsychosocial diagnostic tool was developed which supports health care professionals to 1) predict the risk for pain chronicity, disability or extended absenteeism (risk-index, RSI), and 2) recommend a personalized treatment allocation to uni- or multimodal training (prevention-index, RPI-S). Both tools complement the functional indices developed in the MiSpEx network and add to adequate therapeutic strategies that fit individual needs. The present contribution summarizes the current state of research on psychosocial screenings and reports on the development of RSI/RPI-S.

› **Take Home:** RSI and RPI-S can be used to identify biopsychosocial risk factors, which moderate the intervention success. An early screening is essential for athletes' personalized care management and is strongly recommended.

KEY WORDS:
Pain-Diagnostic, Screening, Risk and Prevention Stratification, Personalized Therapy Allocation

Zusammenfassung

› **Psychosoziale Risikofaktoren** haben einen signifikanten Einfluss auf die Entstehung chronischer, unspezifischer Rückenschmerzen (CURS), denen ein multifaktorielles Ätiologiemodell zugrunde liegt. Die Nationale Versorgungsleitlinie zur Diagnostik und Therapie von Kreuzschmerz empfiehlt daher ein frühzeitiges Screening solcher biopsychosozialen Risikofaktoren, das eine funktionsbezogene Diagnostik komplettiert und zur Ableitung passgenauer präventiver und therapeutischer Interventionen führt. Zu den relevanten psychosozialen Risikofaktoren für die Entstehung von CURS bei Athleten gehören Schmerztoleranz, -verhalten, die Stressbelastung sowie die Qualität des sozialen und medizinischen Versorgungskontexts. Bisherige Screenings sind jedoch kaum auf den Lebenskontext von Athleten ausgerichtet. Weiterhin berücksichtigen sie nicht den moderierenden Einfluss von psychosozialen Risikofaktoren auf die individuelle Adaptationsfähigkeit auf körperliches Training (Responder vs. Non-Responder).

› **An dieser Stelle** setzt das bundesweite Forschungsprojekt Medicine in Spine Exercise (MiSpEx) an: Es wurde ein psychosoziales Screeninginstrument entwickelt, das 1) zuverlässig das Risiko für Schmerzchronifizierung, Beeinträchtigung oder längere Ausfallzeit bei CURS vorhersagt (Risikoindex; RSI) und ein weiteres, das 2) ableitet, ob eine individuelle Risikolage vorliegt, die eine Non-Response auf unimodales Training erwarten lässt und somit eine multimodale Behandlung notwendig macht (Präventionsindex; RPI-S).

› **Beide Instrumente** ergänzen die im MiSpEx Netzwerk entwickelten funktionellen Indices und leisten einen Beitrag zu passgenauen Interventionsstrategien, die individuelle Bedürfnisse und Vermögen der von CURS betroffenen Patienten oder Athleten berücksichtigen.

› **Take Home:** Mit dem RSI und RPI-S lassen sich biopsychosoziale Risikofaktoren identifizieren, die einen Einfluss auf den Interventionserfolg haben. Eine frühzeitige Diagnostik wird für ein individuelles Versorgungsmanagement bei Athleten dringend empfohlen.

SCHLÜSSELWÖRTER:
Schmerzdiagnostik, Screening, Risiko- und Präventionsstratifizierung, personalisierte Therapieauswahl

Introduction

Epidemiology and Risk Factors

Most people experience acute non-specific low back pain (LBP) at least once in their lives. The life time prevalence is between 51% and 84% (19) with high spontaneous remission rates (22). In some cases, however, a first acute pain episode is followed by another which may promote the development of chronic non-specific LBP (CLBP). For athletes, these pain episodes may be highly career limiting. Despite lower life-time prevalence rates of 60% (36) they may experience substantial career limitations due to the loss of training time of up to 28% per year (38).

Research about non-specific medically unexplained CLBP (5) identify bio-psychosocial variables as important risk factors (mainly so-called Yellow Flags (YF)) as well as orange, blue and black Flags) (30). ›

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This lead to the recommendation of the European Guideline for Diagnosis and Therapy of Back Pain (44) that functional tests should be complemented by an early screening of modifiable Flag-factors for personalized treatment and prevention advices. Within a health management context, short and significant item lists are more preferable than excessive diagnostic tools.

Previous Diagnostic Tools

Some more or less established screening-tools already exist to evaluate YF-factors for development of chronic back pain, functional disability or work absenteeism in the general population. These mainly differ in the follow-up period, the dimensions of chronicity (pain, function, return to work status) and in item domains that have been assessed (biological, social, psychological factors). The following small list roughly tries to categorize some of these tools into the assessment of psychosocial and bio-psychosocial factors.

Bio-Psychosocial Related Screening Tools

The Keele StarT Back Screening Tool (SBT) from 2008 (20) consists of nine items only and aims to predict persisting back pain after six months by assessing sociodemographic, work-related, functional and psychosocial variables. Additionally, the instrument is meant to assist in the assignment of individualized treatment strategies for patients at risk of biomedical and psychosocial chronicity (low risk=medical advice for improvement of self-management strategies; medium risk=physiotherapeutic treatment; high risk=additional focus on cognitive-behavioral approaches). Another screening tool that also aims to include bio-psychosocial variables is the Örebro Musculosceletal-Pain-Screening Questionnaire (ÖMPSQ). Its latest and modified version from 2003 (29) consists of 25 items. By its overall score, it aims to predict sickness-related absenteeism after six months and assesses functional-, pain- and psychosocial variables. Subscores allow for the prediction of functional loss and persisting pain. The INTERMED Classification System from 1999 (23) synthesizes information from biologic, psychosocial, social and health care domains in time-contexts such as history, current state and prognosis. By assessing case complexity, individuals can be sub-grouped into a disabled – or chronic stage of low back pain after six months. The oldest questionnaire within this group is the Vermont Disability Prediction Questionnaire (VDPQ) (17) from 1996 which consists of 11 items and aims to predict the return to work status after three months. Assessed are history of back pain, history of treatment and psychosocial variables.

Psychosocial Related Screening Tools

The Heidelberger Kurzfragebogen-Rückenschmerz (HKF-R 10) (34) from 2006 consists of 27 items and mainly aims for early identification of psychosocial risk factors about persisting pain. Items assessing sociodemographic information, pain intensity and duration, efficacy of massage. The risk stratification instrument PickUP (42) from 2016 consists of five items only. It is intended for early identification of patients with acute low back pain in primary care who are at risk of developing chronic low back pain after three months. Based on the Avoidance-Endurance-Model a self-instructed online tool Risikoanalyse der Schmerzchronifizierung-Rücken (RISC-R) was developed (16). The instrument aims to determine the risk of pain chronicity after six months by assessing psychosocial risk factors in individuals that are in a non-chronic state of lower back or lower limb pain.

Most of these instruments were developed and validated for patients in a primary care setting and may not be suited for life and burden of competitive athletes; further they mainly focus on yellow flag factors (YF) such as depression-, fear-avoidance-endurance beliefs and work-related distress. Although there is evidence that these factors are of high relevance for a risk-based management of current, recurrent or chronic unspecific LBP in the general population, assessments for athletes should also respect their specific living conditions. In principle, risk based management strategies for recurrent LBP in athletes should include further flag-factors such as blue and orange that moderate physiological adaption processes due to exercise, and contemporaneously interact with the medical care and life context of athletes. For this reason, one objective within the MiSpEx network was – besides the development of a functional tool – a development of a bio-psychosocial screening tool which could be used for athletes in personalized LBP-prevention and treatment. This was done in three multicenter studies and separate sub-studies, whereby only the multicenter studies comprise all colored flag factors together. Those were further sub-summarized in four domains, namely „pain" (yellow flags: depression, fear-avoidance/endurance, pain-tolerance, ...), „stress" (orange flags: chronic stress, life events/traumatic stress, ...), „social environment" (blue/orange flags: social support, attachment-style, ...) and „medical care environment" (blue/black flags: insurance, availability of medical care providers,...).

Considerable Flag Components in the Context of Athletes

Pain

In contrary to the well analysed flag factor depression, there is less knowledge about the YF factors fear-avoidance and endurance in an athlete's context. Although it would be unlikely that this has a deeper influence (while directly clashing with sponsor and federation duties), it was analysed more in detail in a MiSpEx Network sub-study (PSA 12).

More evident but still discussed from a perspective of adaptation is, if exercising lead to a different or higher pain tolerances (40). On the one hand it is assumed that an exercise induced involvement of opioid and non-opioid mechanisms as well as an exercise induced hypoalgesia may be responsible for the reduced pain perception after physical activity (12, 26). On the other hand athletes may show a less responsive endogenic pain inhibition system which could be caused by altered processing of somatosensory stimuli (39). This was further examined within the PSA15 study of the MiSpEx Network treated by the colleagues Dapunt and Gantz. Here, utilisation of Quantitative Sensory Testing demonstrated highest desensitisation levels on thermic stimuli and the highest thresholds for cold and heat perception for athletes in comparison to pain patients and controls. Further and independent of pain perception and processing, training-induced adjustment effects of the skeleton muscles, a more physical active lifestyle and a longer lasting activity in spite of pain experience (10) may prove protective against emerging LBP in competitive athletes compared to the general population (46).

Stress

Athletes' life is determined from tightened time resources and restricted recreational space. Although they might cope well with their daily demands, high stress peaks and a prolonged activation of stress response systems can be evoked by sticky competition calendars, continental journeys, media and sponsoring commitments as well as family and education duties. Feeling obligated to third party expectations and training as well as competition schedules might keep them physically active in

spite of injuries. Distress and trauma in terms of physiological and emotional neglect in childhood present a further risk factor that is clearly linked to pain in adulthood (11, 28). Studies show, that athletes suffering from chronic stress and life events are more often injured than others (24). Further, a prolonged stress response can provoke an accumulation of physiological costs over time that impair manifold psychoneuroendocrinological adaptation processes within the immune, endocrine and neuronal system. In respect of (high performance) exercise two maladaptation phenomena are of specific interest: the hypercortisolism (e.g. female athlete triad (31)) and the hypocortisolism (e.g. symptom triad: pain, fatigue, atypical depression (14)) both extremely career limiting for athletes. The last named is particularly of interest in the context of pain and was analyzed more in detail in the PSA3 sub-study. Here, 33 biomarkers were used to deduct a small neuropattern blood marker-set for the prediction of pain chronicity due to prolonged stress exposition. Although some studies show, that competitive athletes with increased stress experiences exhibit maladjustment to pain stimuli, the mechanisms between stress, pain and exercise must be considered more closely (7, 26, 49). There is a discussion about the extent of a limited adaptation to exercise due to stress related maladjustment which lead to the challenging question about dose-response relationship (50) and is treated in two further sub-studies (PSA16, PSD10) of the MiSpEx Network.

Social Environment

Attachment theory might also provide another possible linkage between the social environment of the athlete, pain and general performance. Numerous studies were able to show that insecure attachment is associated with worse treatment outcomes of multimodal pain therapies (1, 6, 27, 32, 37). Moreover, this is particularly relevant, as insecure attachment styles are vastly overrepresented in chronic pain patients: around 65% of chronic pain patients can be classified as "insecurely attached", whereas the prevalence of insecure attachment in a healthy, representative population is about 33% (33, 43). Research indicates that attachment behaviour may also be related to developing maladaptive activity patterns in pain patients (3). Hence, secure attachment is associated with lower levels of activity avoidance mediated by lower scores of pain catastrophizing, while preoccupied or fearful attachment is linked to higher levels of overactivity (3).

In the context of athletes, the question remains, whether their attachment style may be influenced by the lifestyle decisions that might commonly go along an athlete's career. Sport focused schools are usually boarding schools, which leads to an early separation of the children from their parents. Later on, athletes might opt to join the Federal Armed Forces or Boarder Guard for their sports promotion programmes, which may further distance the adolescents from their family. In these circumstances, the coach might become a close attachment figure for the young athlete and the attachment relationship with the coach gains in importance above and beyond the merely professional aspects (8, 9, 13). In a study of 309 student athletes, Davis and Jowett (8) showed that coaches fulfilled attachment functions of the secure base, safe haven, and proximity maintenance. Additionally, athlete's avoidant and anxious attachment with the coach was negatively related to sport satisfaction. In young athletes it has been suggested that, parental attachment may be positively connected with self-esteem (25) but also positively linked to higher alcohol intake (2). Athletes with an insecure attachment pattern reach higher scores in cognitive anxiety which seems to negatively affect their performance (15). However, till now, not much is known about the impact of insecure attachment in athletes.

Medical care environment: At least it is to note that the medical care environment for athletes is clearly different of other national or international care management strategies in which the existing studies took place. They have access to more intensive and more individualised medical care on regular basis in comparison to persons of the general population. Until now, there is less knowledge about the influence of the medical care environment on the development of chronic pain in athletes and should be analysed in the multicenter studies.

Diagnosing Psychosocial Risk Factors of CLBP in Athletes

As mentioned before one objective of the MiSpEx Network was to develop a bio-psychosocial screening tool to estimate the risk of becoming unspecific CLBP (risk stratification index, RSI) and a second screening tool for the identification of the prevention needs (risk prevention index, RPI-S). Ideally these tools include all flag factors treated in the separate MiSpEx sub-studies in direct comparison. Further, a tool is needed to identify the individual risk profiles in the different Flag-domains and support a stratified treatment allocation for athletes (46) as well as the general population (48). This difficult objective was achieved in compliance with the Prognosis Research Strategy for clinical outcomes (18) in the three multicenter studies (47): in the first 24-months multicenter observation study both tools were developed and internally validated for a 6-month and 12-months prediction time frame (48). The second multicenter study (three-armed intervention RCT: unimodal, multimodal training, control group) served for the evaluation of the clinical utility of an individual treatment allocation based on the RPI-S (external validation) (45). In the last multicenter study (a two armed 6-months RCT (35)) an a priori allocation of the participants to the treatment based on the RPI-S was intended. Finally, eight items of the RSI predict persisting unspecific low back pain disability and additional nine items predict pain intensity after 6- and 12- months by assessing sociodemographic, work-related, functional, psychosocial and medical care variables. Only three up to sixteen items of the RPI-S suggest individual treatment allocation to training intervention and additional psychosocial therapy modules. The selected indicators fit the Sense of Coherence theory (4) which is important in prevention of psychosomatic syndromes such as pain. The psychometric properties of the RSI like discriminant validity outperform the above listed screening tools (e.g. PICKUP (41, 42), SBT (20, 21), ÖMPSQ (29)). Both screening tools support physicians in their treatment decision, allowing personalized CLBP risk prognosis and giving insides into an athletes' individual psychosocial risk profile in an economic manner.

Take Home Message

Two screening tools are presented identifying biopsychosocial factors which influence the effectiveness of CLBP treatment strategies. In athletes, an early diagnosis is essential for personalized care management, and thus is strongly recommended.

Förderung

Das MiSpEx-Netzwerk wird gefördert aus Mitteln des Bundesinstituts für Sportwissenschaft (BiSp) aufgrund eines Beschlusses des Deutschen Bundestages [Förderkennzeichen ZMVI1-080102A/11-18].

Table 1

Overview about the presented screening tools, their most important development criteria, predictor outcomes, and (clinical) application. RPI-S screening groups: pain experience (RPI-SP); stress (RPI-SS); social environment (RPI-SE); medical environment (RPI-ME). Psychosocial risk factors (flag factors): yellow flags (YF, such as fear-avoidance, catastrophizing, depression), orange flags (OF, such as chronic stress, life events, trauma, lifestyle factors (e.g., substance abuse, alcohol, physical activity, sleep), blue flags (BF, such as work place situation, employed status, duration sickness absence) and black flags (BBF, such as financial incentives, physical demands at work, unemployment rate).

SCREENING TOOL	AUTHORS	YEAR	ITEMS	FACTORS	PREDICTION	TIME	PURPOSE	TARGET GROUP
Vermont Disability Prediction Questionnaire (VDPQ)	Hazard, Haugh, Reid, Preble, MacDonald	1996	11	bio-psychosocial	return to work status	3 months	risk assessment	general population
INTERMED Classification System	Huyse, Lyons, Stiefel, Slaets, de Jonge, Fink, Gans, Guex, Herzog, Lobo, Smith, Schijndel	1999	20	bio-psychosocial	risk of chronic LBP 3 subgroups: disabled vs chronic stage; disability; functional status	6 months	risk assessment	general population
Risikoanalyse der Schmerzchronifizierung-Rücken (RISC-R)	Hasenbring & Hallner	1999	36	psychosocial, YF	risk of chronic LBP, lower limb pain and work ability	6 months	risk assessment and pain processing status	general population
Örebro Musculoskeletal-Pain-Screening Questionnaire (ÖMPSQ)	Linton & Boersma	2003	25 (long version) 10 (short version)	bio-psychosocial, YF	risk of chronic and persisting LBP disability, work ability, functional status (recovered, 1-30 days absent, > 30 days absen)t	6 months	risk assessment	general population
Heidelberger Kurzfragebogen-Rückenschmerz (HKF-R 10)	Neubauer, Junge, Pirron, Seemann, Schiltenwolf	2006	27	psychosocial	risk of chronic LBP 5 subgroups: low risk, probably low risk, no prediction possible, probably high risk and high risk	5 months	risk assessment	general population
Keele StarT Back Screeening Tool (SBT)	Hill, Dunn, Lewis, Mullis, Main, Foster & Hay	2008	9	bio-psychosocial, YF	risk of chronic and persisting BP 3 subgroups: low (LR), medium (MR), high risk (HR)	6 months	risk assessment stratified treatment allocation (LR= medical advice, MR= unimodal: physiotherapy, HR= multimodal biopsychocial training)	general population
PickUP	Traeger, Henschke, Hubscher, Williams, Kamper, Maher, Moseley & MacAuley	2016	5	psychosocial	risk of chronic LBP pain intensity and disability	3 months	risk assessment	general population
Risk prevention index (RPI-S)	Wippert, Puschmann, Drießlein, Arampatzis, Banzer, Beck, Schiltenwolf, Schmidt, Schneider, Mayer	2017	3 to 16	bio-psychosocial, YF, BF, OF, BBF exercise status	Biopsychosocial risk profiles in chronic LBP genesis RPI-S subgroups: RPI-SP, RPI-SS, RPI-SSE, RPI-SME	6 and 12 months	risk assessment personalized stratified treatment allocation unimodal = exercise / multimodal = exercise and individual risk profile treatment (RPI-SP, RPI-SS, RPI-SSE, RPI-SME)	general population, athletes
Risk stratification index (RSI)	Wippert, Puschmann, Drießlein, Arampatzis, Banzer, Beck, Schiltenwolf, Schmidt, Schneider, Mayer	2017	8 to 17	bio-psychosocial, YF, BF, OF, BBF	risk of chronic LBP pain intensity and disability	6 and 12 months	risk assessment	general population, athletes

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