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2. Red flags: Implications for patient management and self-management



Series authors

Víctor Doménech-García¹, Julia Blasco-Abadía¹, Kieran O'Sullivan², Lara Coyne², Mary O'Keeffe^{3,4}, Nathan Skidmore^{3,5}, Zsófia Nagy^{3,6}, Thorvaldur Skuli Palsson^{7,8}, Steffan Wittrup McPhee Christensen^{9,10}, Morten Hoegh⁹, Alice Baroncini¹¹, Domenico Compagnone¹¹, Pedro Berjano¹¹, Lisa Zauber¹², Pablo Bellosta-López¹.

¹ Universidad San Jorge. Campus Universitario, Autov. A23 km 299, 50830. Villanueva de Gállego, Zaragoza, Spain.

² School of Allied Health, University of Limerick, Ireland.

³ European Pain Federation EFIC, Brussels, Belgium.

⁴ School of Public Health, Physiotherapy and Sports Science, University College Dublin, Dublin, Ireland.

⁵ Department of Sport, Exercise and Rehabilitation, Northumbria University, UK.

⁶ Rétköz Health Center, Budapest, Hungary.

⁷ Department of Clinical Medicine, Aalborg University, Aalborg Denmark.

⁸ Department of Physiotherapy and Occupational Therapy, Aalborg University Hospital, Denmark.

⁹ Department of Health Science and Technology, Aalborg University, Aalborg, Denmark.

¹⁰ Department of Physiotherapy, University College of Northern Denmark, Aalborg, Denmark.

¹¹ IRCCS Ospedale Galeazzi-Sant'Ambrogio, Milan, Italy.

¹² Research & Development Department, SYNYO GmbH, Vienna, Austria.

Volume lead: Alice Baroncini¹¹, Domenico Compagnone¹¹, Rafael Giner-Nicolás¹.

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Synopsis

Digi4MSK is an Erasmus+ project that develops learning resources to improve how professionals communicate about musculoskeletal health and implement evidence-based self-management. This resource synthesizes high-quality research into concise, actionable guidance for everyday practice. Each volume offers structured summaries, tools, and examples to support shared decision-making, health literacy-sensitive communication, and safe, person-centred care across musculoskeletal conditions.

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The first four volumes include: the requirements for the implementation of self-management, general principles of self-management, excluding serious pathology in musculoskeletal pain, and assessment of a patient’s readiness in terms of motivation and health literacy.

Volume 2 — Red flags: Implications for patient management and self-management

This volume summarizes red flags in musculoskeletal presentations and their implications for clinical reasoning before initiating self-management. It highlights red flags for the spine and limbs, clarifies thresholds for escalation and referral, and supports safe decision making. Tables and concise checklists facilitate rapid use in busy clinical settings.

Keywords: red flags, screening, safety, clinical reasoning, escalation, referral.

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2. Red flags: Implications for patient management and self-management

2.1 Objectives

The general objective of this chapter is to upgrade and strengthen the clinical competencies of healthcare professionals in identifying signs and symptoms (red flags) that may indicate serious pathology in patients presenting with musculoskeletal pain, particularly in first-contact setting. The identification of red flags would require patient referral, and the initiation of self-management would be contraindicated.

The specific objectives of this chapter are:

- *To list the most relevant red flags associated with serious conditions (e.g., fracture, infection, cauda equina syndrome, etc) in patients presenting musculoskeletal pain.*
- *Interpret patient history and clinical signs to distinguish between typical musculoskeletal pain and potential indicators of serious pathology.*
- *Decide when to continue with self-management interventions or when to refer for urgent medical evaluation.*

2.2 Introduction: Screening for Red Flags before implementing self-management.

At present and in several countries, many patients come to physiotherapy or other health professionals as a first contact with the health system, without having been referred by another professional or having been referred without a thorough assessment.

For this reason, identifying potential serious conditions or factors that may lead to a poorer prognosis is key to establish the most appropriate management strategies by the physiotherapist from the outset, and to support patient self-management.

The red flag assessment system provides a clinical reasoning framework to determine whether a patient requires immediate medical attention or could safely engage in self-management.

Red flags are clinical signs, symptoms or medical history items suggesting serious underlying pathology, such as malignancy, infection, or neurological compromise. They need urgent evaluation to avoid severe consequences, including permanent disability or life-threatening complications. Recognizing these indicators is particularly crucial in spine surgery, where delays in diagnosis can have catastrophic outcomes.

This section explores red flags mainly in spine (where it is more frequent for serious pathology to mimic a musculoskeletal condition), and limbs pathological conditions, providing detailed explanations, discussing their significance, and emphasizing the importance of their identification in clinical practice (Henschke et al., 2009; Jarvik & Deyo, 2002; Verhagen et al., 2016).

2.3 Red Flags for Spine

2.3.1 Pain Lasting More Than Six Weeks

Current clinical guidelines recommend that back pain persisting for more than six weeks should be investigated with at least plain radiography, in order to exclude structural causes that may not be evident clinically. Persistent back pain lasting longer than six weeks may indicate conditions beyond non-specific or uncomplicated mechanical back pain. At this stage, clinicians should consider underlying serious pathologies such as malignancies (e.g., multiple myeloma, metastases, primary tumours), infections (e.g., vertebral osteomyelitis, spondylodiscitis), systemic inflammatory disorders (e.g. ankylosing spondylitis), or osteoporotic fractures that may occur even in the absence of trauma, often as a result of minor strain or effort. Pain of this nature often fails to improve with standard conservative management and therefore warrants advanced diagnostic evaluation, including appropriate imaging and laboratory investigation. Early identification of the underlying cause is critical to prevent the progression of potentially debilitating or even life-threatening conditions, enable timely initiation of treatment and improve patient outcomes. If the necessary imaging and laboratory findings rule out a specific diagnosis that requires surgical or pharmaceutical therapy, structured self-management may still be considered a valid therapeutic option.

2.3.2 Age Under 18

Back pain in children and adolescents is relatively uncommon and, when present, should raise concerns about specific underlying conditions such as congenital anomalies, spinal infections, or neoplastic processes (e.g. osteosarcoma) or inflammatory disorders (e.g. juvenile idiopathic arthritis). This age group also presents unique pathologies, most notably spondylolysis - a defect of the pars interarticularis - which is frequently observed in athletes engaged in sports involving repetitive lumbar hyperextension, such as gymnastics, diving, or football linemen. If unrecognized, these conditions can progress to more severe deformities, such as spondylolisthesis, or chronic issues, impairing spinal function and quality of life and requiring surgeries of spinal fusion. While pain is not always the predominant presenting symptom in spinal deformities, early diagnosis and targeted management are essential to prevent progression and functional compromise. Careful history-taking, focused physical examination, and appropriate imaging studies are crucial to identify these conditions early and ensure timely referral to specialist care.

2.3.3 Age Over 50

In patients over 50, new-onset back pain should raise concern for serious underlying conditions, including metastatic cancer, abdominal aortic aneurysms, or advanced degenerative spinal disorders. This population frequently presents with multiple comorbidities that may complicate both diagnosis and management. For example, osteoporosis substantially increases the risk of vertebral fractures, which, as said, may occur even after minor or low-energy trauma. A thorough diagnostic work-up, incorporating appropriate imaging modalities such as plain radiographs, CT scans, or MRI, is essential to distinguish between common degenerative changes and more serious pathologies causing pain. Timely recognition and management of these conditions are crucial to prevent complications, including potentially life-threatening emergencies such as aneurysm rupture. However, once imaging and laboratory investigations have excluded diagnoses requiring targeted surgical or pharmacological intervention, patients whose pain is attributable to mechanical or degenerative causes may be safely directed toward structured self-management strategies as part of their treatment plan.

2.3.4 Trauma

Trauma, particularly in older adults or patients with osteoporosis, is a leading cause of vertebral fractures. Even low-energy injuries, such as falls from standing height, can result in significant structural damage to the spinal column. If not promptly recognized and managed, these injuries may lead to spinal instability, chronic pain, or neurological compromise. Accurate assessment requires appropriate imaging, most commonly plain radiography or CT scans, to determine the presence and the type of the fracture. In many cases, MRI is also necessary — even as an urgent but deferrable examination when no neurological deficits are present — in order to accurately assess bone marrow oedema and date the fracture. Early identification of trauma-related vertebral fractures enables timely and tailored management, which may include bracing, physical therapy, or surgical stabilization, depending on the severity and stability of the lesion.

2.3.5 History of Cancer

A history of cancer is a major red flag in patients present with back pain, as it significantly increases the likelihood of spinal metastases. Different malignancies, such as breast, prostate, lung, kidney and colorectal cancers, frequently metastasize to the vertebrae due to their rich vascular supply and venous plexus connections. Metastatic spinal disease may manifest with axial pain, mechanical instability, and, in advanced stages, spinal cord compression. Importantly, spinal cord compression constitutes an absolute surgical emergency, as untreated neurological deficits can rapidly deteriorate or become irreversible if timely decompression is not achieved. Similarly, back pain in patients with a history of primary vertebral tumour should raise concern for local recurrence. Accurate diagnosis relies on advanced imaging modalities, including bone scintigraphy, PET/CT scans, and MRI, which are invaluable for detecting lesions, assessing their extent and guiding treatment. Early detection and multidisciplinary management can significantly improve prognosis, alleviate pain, preserve neurological function and maintain quality of life.

2.3.6 Fever, Chills, Night Sweats, Weight Loss, Night Pain

Systemic symptoms such as fever, chills, night sweats, unexplained weight loss, or persistent night pain are key red flags strongly associated with serious underlying conditions. These include infections like vertebral osteomyelitis, discitis or epidural abscesses as well as malignancies such as multiple myeloma or metastatic disease. Night pain unrelieved by rest is

particularly worrisome, as it suggests a non-mechanical aetiology of back pain, and should never be dismissed as benign. The presence of these symptoms should prompt urgent diagnostic evaluation, typically combining MRI of the spine and blood tests, including inflammatory markers (C- Reactive Protein, Erythrocyte Sedimentation Rate) and blood cultures. Early recognition and treatment are essential, as delayed diagnosis can lead to catastrophic complications such as sepsis, irreversible neurological injury, or uncontrolled disease progression.

2.3.7 Intravenous Drug Use

Intravenous drug use represents a major risk factor for spinal infections, including bacterial osteomyelitis, discitis, and epidural abscesses. Pathogens like *Staphylococcus aureus* and *Pseudomonas aeruginosa* frequently gain access to the bloodstream through contaminated needles and may localize to the spine via hematogenous spread. These infections can rapidly progress, leading to systemic sepsis, progressive spinal instability, or irreversible neurological compromise if not promptly treated. Early recognition through imaging and microbiological studies allows for timely administration of antibiotics or surgical intervention to address these life-threatening complications.

2.3.8 Immunosuppression

Patients with immunosuppression, whether secondary to medical treatments such as chemotherapy, long-term corticosteroid use, or underlying conditions such as HIV, are at increased risk for spinal infections that are uncommon in immunocompetent individuals. Opportunistic infections, including fungal and atypical bacterial pathogens (e.g., *Mycobacterium tuberculosis*), may involve the spine and lead to severe, potentially life-threatening complications. These infections often present with insidiously, with subtle or non-specific symptoms, making early diagnosis particularly challenging. For this reason, clinicians must maintain a high index of suspicion and a low threshold for investigation, employing appropriate imaging and microbiological studies. Prompt and targeted treatment is critical and may require broad-spectrum or pathogen-directed antimicrobial therapy, antifungal agents, and, when indicated, surgical intervention in addition to supportive care.

2.3.9 Recent Gastrointestinal or Urogenital Surgery

Spinal infections secondary to recent gastrointestinal or urogenital surgeries often result from haematogenous spread of bacteria. For instance, pathogens like *Escherichia coli* or *Enterococcus* can travel via the bloodstream or per proximity, causing discitis or vertebral osteomyelitis. Patients with this history presenting with back pain should undergo thorough evaluation, including blood cultures and MRI, to identify possible infections. Early diagnosis and treatment are essential to prevent complications like abscess formation or neurological compromise.

2.3.10 Pain Unresponsive to Therapy or Pain at Rest

Pain that persists despite conservative therapy or occurs at rest should be regarded as a red flag for potential serious underlying conditions, such as malignancies, infections, or vascular pathologies like aortic aneurysm. In contrast to mechanical back pain, which typically improves with rest or activity modification, non-mechanical pain can reflect structural or systemic disease. Patients presenting with these features require advanced imaging and laboratory studies to identify and address the underlying pathology. Delayed recognition increases the risk of disease progression, significant morbidity, and permanent loss of function, with a substantial impact on quality of life.

2.3.11 Use of Anticoagulants

Anticoagulant use is a red flag due to the increased risk of spontaneous or trauma-induced spinal hematomas. Hematomas can compress the spinal cord or nerve roots, leading to acute neurological deficits such as weakness, sensory loss, or paralysis. Patients with back pain and neurological symptoms on anticoagulants should undergo urgent MRI to confirm the diagnosis and facilitate prompt surgical evacuation if needed. Delays in treatment can result in permanent deficits.

2.3.12 Radicular Pain with Neurological Deficits

Radicular pain accompanied by neurological deficits, such as weakness, sensory loss, numbness, or reflex changes, strongly suggests nerve root compression. The most common aetiologies include herniated discs, foraminal stenosis, or spinal tumours. If left untreated, persistent compression may lead to permanent nerve damage. The presence of a severe motor deficit or the presence of signs of myelopathy constitutes a surgical emergency, requiring

immediate diagnosis and prompt intervention when indicated. For example, in case of lumbar disc herniation with motoric deficit, the chances of complete symptom remission are close to 80% if surgery is performed within 48 hours from the onset of the symptoms but falls to below 20% if surgery is delayed to within a week from symptoms onset.

2.3.13 Faecal or Urinary Incontinence, Anuria, Saddle Anaesthesia

These symptoms are hallmark signs of cauda equina syndrome, a true surgical emergency requiring immediate decompression. Cauda equina syndrome results from severe compression of the cauda equina nerve roots, most commonly due to massive lumbar disc herniations, trauma, or tumours. Without urgent surgical intervention, patients are at high risk of irreversible deficits, including loss of bowel, bladder, and sexual function, as well as permanent lower limb weakness. Early recognition and urgent referral for surgical evaluation are critical to preserving neurological function.

2.3.14 Cephalalgia, cervical pain, instability with previous physical trauma in cervical spine

These symptoms can be accompanied by cervical stiffness and other neurological symptoms and can be related to instability in the upper cervical spine. Specific tests (for transverse and alar ligaments) are designed to identify this condition (Hutting et al., 2013). Manual therapy and exercises for gain mobility can be forbidden, and referral for image diagnosis is necessary.

2.3.15 Neurological symptoms like diplopia, dizziness, drop attack, dysarthria, dysphagia, numbness, clumsiness, along with neck pain

These are possible symptoms and signs related to cervical artery dysfunction (Kerry & Taylor, 2006), a vascular condition that requires a medical assessment, and no specific orthopaedic test nor manual therapy techniques are recommended if pre-ischemic symptoms are present. It is important to collect information of risk factors (past history of trauma to cervical spine, hypertension, hypercholesterolemia, vascular disease, diabetes mellitus, blood clotting disorders, anticoagulant therapy, ...) and to explore blood pressure, cranial nerves, ocular examination, pulse palpation and proprioceptive test (Kerry & Taylor, 2014).

2.4 Red Flags for Limbs

Apart from the factors specific to the spine, the ones described above can be applied to peripheral symptoms in relation to fractures, neoplasms, infections or systemic diseases. Some others can be:

1. Shoulder region: referred pain is common in this area for lung cancer (including Pancoast tumours), myocardial infarction, pleural disease, or abdominal/diaphragmatic pathology (Brindisino et al., 2022).
2. Hip region: pain can be related to avascular necrosis. Paediatric-specific pathologies (Legg-Calve-Perthes disease, slipped femoral capital epiphysis, acetabular dysplasia) must be considered, as well as for tumours and occult fractures in older adults (e.g. ramus fractures of the pelvis)
3. Lower limbs: Deep Vein Thrombosis (DVT) and Peripheral Artery Disease (PAD) are more frequent in lower limbs. **Deep Vein Thrombosis** (DVT) is a condition when there is a presence of a blood clot in the deep veins, commonly found in the lower extremity. Detection of DVTs can lead to the prevention of potentially fatal complications including pulmonary embolisms. **Peripheral arterial disease** (PAD) is a condition in which there is a narrowing of arteries in the body outside of the heart, most commonly affecting the legs. One of the common symptoms of PAD is intermittent claudication (patients will complain of pain and cramping in the leg), commonly the calf, when doing exercise and disappearing with rest. In physical examination, Wells Score is a screening tool that considers the patient's clinical presentation and risk factors for DVT, classifying the patient as likely or unlikely. The 6 Minute Walk Test and ankle brachial index (ABI) are useful to identify PAD (Kim, 2019; Riddle et al., 2004). Discoloration, pain, warmth, swelling, and tenderness of the affected extremity are signs and symptoms to pay attention to when screening for both DVT and PAD.

2.5 Clinical Reasoning

Red flags are clinical indicators of serious pathology, and one alone probably has poor values of sensitivity and specificity for a given pathology. It is mandatory to analyse these signs and symptoms within the individual context (e.g. a patient can be using anticoagulant but he is not showing symptoms with relation to this circumstance) of a patient's history and the clinical examination and to pay attention to the presence of several indicators at the same time (Finucane et al., 2020).

There are not described in the literature many clusters of red flags with sensitivity and specificity values. For lumbar fracture values evolve from 0.97 sensitivity – 0.06 specificity when 1 item positive from 5, to 0.03 sensitivity – 1.0 specificity when 5 positives from 5 (Jarvik & Deyo, 2002), what clearly indicates the importance of identifying several red flags markers to enhance the decision of the clinical to refer to medical attention.

2.6 Summary of key messages

- Effective management of spinal and musculoskeletal disorders require careful identification of potential risks for serious or life-threatening pathology.
- Red flags indicate potentially serious medical conditions that need urgent attention. Recognizing these indicators helps clinicians avoid missed diagnoses and optimize resource use.
- Successful assessment of red flags must be interpreted in the individual context of the patient.
- Excluding red flags is essential before initiating and supporting safe self-management.

2.7 Tables

2.7.1 Table 1: Overview of Red Flags for Spine

Red Flag	Possible Causes	Significance
Pain Lasting More Than Six Weeks	Tumour, infection, rheumatologic disorders, fractures	Signals potentially serious pathology requiring further evaluation.
Age Under 18	Congenital defects, malignancy, infection, spondylolysis	Indicates uncommon but potentially serious conditions needing prompt attention or targeted care.
Age Over 50	Metastasis, aortic aneurysm, degenerative disease, fractures	Suggests systemic or degenerative conditions warranting thorough investigation.
Trauma	Vertebral fractures	Raises the risk of instability or chronic pain, especially in elderly or osteoporotic individuals.
History of Cancer	Spinal metastases, recurrence	Requires urgent imaging to rule out malignancy in patients with back pain.
Fever, Chills, Night Sweats, Weight Loss, Night Pain	Infection, malignancy	Strongly associated with serious systemic illnesses like spinal abscess or cancer.
Intravenous Drug Use	Spinal infections (e.g., osteomyelitis, discitis, abscess)	Increases risk of bacterial infections requiring immediate intervention.
Immunosuppression	Spinal infections	Heightens susceptibility to rapidly progressing infections.

Red Flag	Possible Causes	Significance
Recent Gastrointestinal or Urogenital Surgery	Hematogenous spread of infections	May lead to epidural abscesses or osteomyelitis.
Pain Unresponsive to Therapy or Pain at Rest	Tumours, infections, visceral pathologies	Highlights potential non-mechanical causes requiring urgent management.
Use of Anticoagulants	Spinal hematoma	Poses a risk of acute neurological deficits due to compression.
Radicular Pain with Neurological Deficits	Nerve root compression (e.g., disc herniation)	Indicates need for timely intervention to prevent permanent damage.
Faecal or Urinary Incontinence, Anuria, Saddle Anaesthesia	Cauda equina syndrome	An emergency requiring immediate surgical decompression to prevent irreversible damage.
Cephalalgia, cervical pain, instability with previous physical trauma in cervical spine	Upper cervical spine instability	Risk of neurological deficits.
Neurological symptoms like diplopia, dizziness, drop attack, dysarthria, dysphagia, numbness, clumsiness, along with neck pain	Cervical or carotid artery dysfunction	Risk of neurological deficits, dangerous condition for manual therapy in cervical spine.

2.7.2 Table 2: Overview of Red Flags for Limbs

Many of the Table 1 can be considered also for limbs

Red Flag	Possible Causes	Significance
Smoking, pleuritic pain, cardiac risk factors	Lung cancer, myocardial infarction	Signals potentially serious pathology requiring further and urgent evaluation.
Pain and disability without trauma in the hip	Avascular Necrosis (AVN). Paediatric: Legg-Calve-Perthes disease, slipped femoral capital epiphysis, acetabular dysplasia Adults: tumours and occult fractures in older adults	Signals potentially serious pathology requiring further evaluation and decreased loading.
Discoloration, pain, warmth, swelling, and tenderness of the affected extremity	Deep Vein Thrombosis (DVT) and Peripheral Artery Disease (PAD)	Highlights potential non-mechanical causes requiring further medical investigation and urgent management.

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