Low-Back Pain

6

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6.1 Introduction

Low-back pain (LBP) is mainly managed in primary health care. It is a symptom that is commonly belittled and misdiagnosed. This chapter aims to present a simple approach for the diagnosis and assessment of LBP according to the latest clinical recommendations. This content will discuss in details the definition and prevalence of LBP and the important stepwise approach to reach a diagnosis and start treatment. This approach starts from history-taking, physical examination, and radiological studies and, finally, concludes with the management and referral guidelines. Also, inflammatory back

pain will be explained thoroughly in an easy to digest way.

A major advantage of this chapter is that carefully designed tables, diagrammatic presentations, and illustrations were used to help practicing clinicians perform proper and adequate work up for patients with LBP.

6.2 Learning Objectives

By the end of this chapter, you should be able to:

1. Present a comprehensive approach for the diagnosis and assessment of low-back pain in accordance with updated clinical guidelines.
2. Recognize the red flags of LBP and the proper time for referral.
3. Prevent the delay of the diagnosis and management of inflammatory back pain (IBP) to avoid the long-term disabilities.

6.3 Definition

LBP is defined as pain or stiffness in the area between the costal margin and the inferior gluteal folds; this pain could also extend to the lower limbs [1]. LBP can also be classified as acute or chronic; this would be helpful for prognostic and management purposes. Acute

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LBP is considered if the symptom was present for less than 6 weeks, while sub-acute and chronic would be considered if the pain lasts from 6 to 12 weeks and more than 12 weeks, respectively [2]. Table 6.1 shows some important definitions for some terminologies used while dealing with patients complaining of LBP.

6.4 Prevalence

LBP is a worldwide problem that is more commonly found in females and those aged between 40 and 80 years [3–5]. Lifetime prevalence of LBP has increased significantly to become as high as 84%, while chronic LBP has reached 23%. Of this population, 11–12% will develop some form of impairment or disability.

6.5 Differential Diagnosis

Back pain is a frequently encountered symptom that could be caused by many specific and non-specific underlying causes, as shown in Table 6.2. However, mechanical low-back pain represents 97% of the causes [6].

6.6 Approach to Diagnosis

When assessing a patient presenting with LBP, it is important to rule out neurologic deficits or other serious inflammatory or medical conditions with a focused history and physical examination. Thorough assessments are also important to aid physicians in screening the patients who need further diagnostic investigations to rule out serious pathologies (see Fig. 6.1) [7, 8].

Table 6.1 Important terminologies in low-back pain

Spondylosis	A degenerative osteoarthritis of the spine. It can be seen radiographically as a narrowed disc with arthritic changes
Spondyloarthritis	Also called spondyloarthropathy is a group of inflammatory rheumatic diseases that cause arthritis. The most common is ankylosing spondylitis, which affects mainly the spine. Others include reactive arthritis, psoriatic arthritis, and enteropathic arthritis/spondylitis associated with inflammatory bowel diseases
Spondylolisthesis	Anterior or posterior displacement of a vertebra or the vertebral column in relation to the vertebrae below. The slippage is determined by spinal X-ray and graded from grade 1 to 4 Grade 1: Less the 25% slippage Grade 2: 25%–50% slippage Grade 3: 50%–75% Grade 4: More than 75%
Spondylitis	Inflammation of vertebrae manifested by back pain and progressive stiffness of the spine. The inflamed spine can be visible in MRI
Discitis	An inflammation of the intervertebral disc space often related to infection
Radiculopathy	Impairment of a nerve root, usually causing radiating pain, numbness, tingling, or muscle weakness that corresponds to a specific nerve root

The history-taking elements for LBP include the following:

- Type of onset and character may hint at the underlying pathology:
 - Bones: dull and nagging.
 - Muscles: dull aching.
 - Nerves: sharp and lightning like.

Table 6.2 Lower-back pain causes and risk factors

Specific causes of LBP	<p>Musculoskeletal:</p> <ul style="list-style-type: none"> • Musculoligamentous strain: Experienced by up to 80% of population at some time • Fibromyalgia: Widespread pain in all 4 quadrants of the body, at least 3 months, 11 out of 18 positive tender points on physical exam • Osteoarthritis: Affects mainly the hips, knees, spine, first CMC, DIP, and PIP • Rheumatoid arthritis: May affect facet joints. It presents with pain, swelling, and impaired function of joints with morning stiffness for ≥ 1 hour and has extra-articular manifestations, positive RF, and ACPA • Spondylolisthesis: Dull, aching pain in the lower lumbar or upper sacral region. Pain also extends into the buttocks or posterior thigh • Vertebral compression fracture: Symptoms could mean compression of the nerves at the fracture site: Numbness, tingling, weakness, and incontinence • Inflammatory: Spondyloarthritis (ankylosing spondylitis, reactive arthritis, psoriatic arthritis) <p>Spinal cord: Myelopathy Nerve root: Radiculopathy Degenerative or traumatic: Disc herniation, spondylosis, fracture Metabolic: Paget's disease, osteomalacia Neoplastic: Lung, breast, prostate, multiple myeloma, lymphoma Infectious: TB discitis, osteomyelitis, epidural abscess, zoster, Lyme, CMV, HIV Referred pain:</p> <ul style="list-style-type: none"> • Gastroenterology: PUD, cholelithiasis, pancreatitis, pancreatic cancer • Genitourinary: Pyelonephritis, nephrolithiasis, uterine or ovarian cancer, salpingitis • Vascular: Aortic dissection, leaking aortic aneurysm
Nonspecific causes	Poor posture, sitting and standing, lifting ergonomics, unknown causes
Risk factors	Overweight, smoking, pregnancy, long-term use of medication (e.g., corticosteroids), stress, depression, occupation

CMC carpometacarpal joint, DIP distal interphalangeal joint, PIP proximal interphalangeal joint, RF rheumatoid factor, ACPA anti-citrullinated protein antibodies, CMV cytomegalovirus, HIV human immunodeficiency virus, PUD peptic ulcer disease

- Nerve root: sharp and shooting.
- Sympathetic nerve: burning, pressure like, stinging, and aching.
- Vascular: throbbing and diffuse.
- Duration: this would help guide imaging and treatment decisions.
- The site of pain and any radiation: this would help to rule out radiculopathy.
- Intensity of the pain.
- Continuous versus on and off.
- Progressive or not.
- Factors that improve or worsen the pain: day-time vs nighttime, certain positions, activity vs rest, and response to treatments.
- Severity of pain.
- Associated symptoms: extra-axial joint pain, sciatica, paresthesias, pseudoclaudication, and bowel/bladder dysfunction.
- Assess for symptoms specific for certain diseases like spondyloarthropathies, i.e., enthesitis, dactylitis, history of psoriasis, and bowel symptoms.
- Assess for red flags (see “radiological studies”):
 - History of trauma [9].
 - Symptoms suggestive of an infection or malignancy, i.e., fever and unexplained weight loss.
 - Neurological deficits or other symptoms that may give a clue to serious underlying pathologies like cauda equine syndrome, compression fractures, spinal stenosis, herniated disc, or radiculopathy.
- Review of systems:
 - Referred pain due to underlying visceral pathologies.

Fig. 6.1 Approach to back MSK examination

- Past medical and surgical history:
 - Previous history of cancer.
 - Medications.
 - History of osteoporosis and/or pathologic fractures.
 - Anxiety or depression.
- Social history: history of smoking, illicit drug use, and type of work.
- The physical examination steps for the assessment of LBP include the following (see Fig. 6.2):

Fig. 6.2 Simple approach of LBP

- Inspection for skin changes and gait abnormalities.
- Palpation for tenderness.
- Range of motion.
- Special tests (Table 6.3).

Table 6.3 Special tests for LBP

Special test	Technique and significance
Straight leg raise test (SLRT)	<ul style="list-style-type: none"> • To test for the presence of a disc herniation • In supine position, flex the patient's hip while maintaining the knee in full extension • Watch for the degree of hip flexion where the patient reports pain • Positive SLRT: Radicular pain down the posterior portion of the tested leg at 40 degrees of hip flexion or less • Sensitivity 33%, specificity 87%
Slump test	<ul style="list-style-type: none"> • Ask the patient to hold hands behind his/her back while seated upright • Instruct to the patient to (slump) flex his/her spine, followed by neck flexion • With examiner's hand on top of head, the patient performs knee extension and dorsiflexion of foot • Ask the patient to return the neck to neutral (no flexion) • Positive slump test: The patient's symptoms are increased in the slumped position and released as the patient actively extends • Sensitivity 84%, specificity 83%
Patrick's test (FABER)	<ul style="list-style-type: none"> • To assess for the sacroiliac joint dysfunction or hip joint pathology • In supine position, bring the tested leg to hip flexion, abduction, and external rotation • Against the medial knee, try to bring the bent leg passively towards the table • Positive test: Reproduction of groin pain or buttock pain • Sensitivity 82%
Compression test	<ul style="list-style-type: none"> • To assess for the sacroiliac joint dysfunction • While standing behind the patient, bring him/her to sideline position • Ask the patient to flex hip at 60 degrees and knees at 90 degrees • Apply an inward/downward force on iliac crest • Positive test: Pain on sacroiliac joint • Sensitivity 69% and specificity 93%

Table 6.3 (continued)

Special test	Technique and significance
<i>Modified-modified Schober test</i>	<ul style="list-style-type: none"> • Identify the PSISs by marking the inferior margins of the patient's PSISs with his or her thumbs • Mark along the midline of the lumbar spines horizontal to the PSISs • Make another mark 15 cm above the original mark • With a tape pressed firmly on the line between the two marked points, instruct the patient to bend forward into full lumbar flexion • Measure the new distance between the superior and inferior skin markings • Distance increases less than 5 cm indicates limited lower back flexion
Neurological assessment	<ul style="list-style-type: none"> • Measure the muscle bulk by tape • Assess for muscle power: Hip flexion (L2), knee extension (L3), ankle dorsiflexion (L4), big toe extension (L5), and ankle plantar flexion (S1) • Check knee reflex (L3 and L4) and ankle reflex (L5 and S1) • Check for skin sensory loss • Assess anal sphincter tone by digital examination (S3, 4, 5)

PSIS posterior superior iliac spine, *L* Lumbar vertebrae, *S* Sacral vertebrae

6.7 Radiological Studies for LBP

Acute LBP that is free of any red flags is generally a benign and self-limiting condition that does not warrant any further imaging evaluation. If there are any signs of complications, an MRI should be requested as it has replaced CTs and myelographies as the first-line imaging modality. MRIs are useful for detecting infections and neoplasia and for postoperative assessments. However, CTs are more useful in patients with abnormalities in bone structure and for evaluation of surgical fusion or instrumentation procedures. CTs are also useful when MRIs are contraindicated. Other imaging modalities like myelography/CT, discography/CT, and radioisotope bone scans can be used in selected patients [10, 11].

Red flags that warrant further imaging [9]:

- Onset above age 70 years old.
- Pain that has persisted for more than 6 weeks.
- History of trauma, even mild trauma in patients aged >50.
- History of surgery in the same site of pain.
- History of malignancy.
- History of IV drug abuse.
- History of osteoporosis or long-term use of steroids.
- Weight loss that is unexplained.
- Fever without an obvious source of infection.
- The presence of focal neurological deficits.
- The use of immunosuppressive medication.

Imaging studies that may be considered include:

1. X-ray

- It is useful in delineating degenerative bone disease, disc prolapse, spondylolisthesis, fractures, and neoplasia and to assess prior surgical interventions.
- Erythrocyte sedimentation rate (ESR) is a useful tool that can suggest the presence or absence of an infection or neoplasia. In patients with no more than 1 risk factor for systemic disease and an ESR less than 20, infections and malignancy would be considered less likely.

2. CT

- It can help in detecting degenerative bone disease, spondylolisthesis, fractures, and malunion. It can also delineate inflammation in the sacroiliac joints.
- It can show false-positive findings following trauma.

3. MRI

- This is the optimal imaging modality for detection of soft tissue abnormalities. It should be offered to patients presenting with neurological deficits. It is a valuable tool for detecting conditions like disk herniation, spinal stenosis, osteomyelitis, discitis, spinal epidural abscess, bone metastasis, arachnoiditis, and neural tube defects.

- It can reveal inflammatory changes in the sacroiliac joints before they start showing on plain X-rays.

4. Electromyography (EMG)

- It is useful in patients complaining of radiculopathic pain with inconclusive findings on imaging modalities who may be considered for surgery.
- It can be helpful in patients who were found to have multilevel affection on imaging.

5. Radionuclide bone scans

- It is a more sensitive tool than plain X-rays, especially for the detection of hidden infections or malignancy.
- In patient who have normal ESR values and plain radiographs, however, these will be of limited utility.

6.8 Detection of Inflammatory Back Pain

Inflammatory back pain (IBP) is usually diagnosed late especially in primary care settings. Causes for this delay may include difficulties in differentiating between mechanical and inflammatory back pain. IBP can lead to significant functional disability. The longer the diagnosis is delayed, the worse the functional outcome [11, 12].

Seronegative spondyloarthropathies are an important cause of IBP. They are a group of inflammatory diseases that are characterized by seronegative arthritis (rheumatoid factor negative) which is linked with the presence of the human leukocyte antigen HLA-B27.

The seronegative spondyloarthropathies include the following disorders:

- Undifferentiated spondyloarthritis.
- Ankylosing spondylitis: involves the spine, peripheral joints, and entheses. This disorder is a frequently underdiagnosed cause of low-back pain.
- Reactive arthritis or Reiter's syndrome: presents with conjunctivitis, urethritis, and arthritis.

- Spondyloarthritis associated with psoriasis: arthritis that is associated with psoriasis.
- Spondyloarthritis with inflammatory bowel disease: Crohn's disease and ulcerative colitis are often associated with ankylosing spondylitis or peripheral arthritis.
- Juvenile onset ankylosing spondylitis: affects children under the age of 16 years.

IBP definition criteria includes the following items [13, 14]:

- The pain has an insidious character.
- Pain increases at night.
- Pain that improves with activity and does not improve with rest.
- Onset of pain occurs in patients <40 years of age.

Four criteria out of five are required to make a diagnosis of IBP. The sensitivity and specificity of these criteria are at 77% and 91.7%, respectively. Referral to a rheumatologist should be considered if these criteria are fulfilled (Fig. 6.3) [15, 16].

6.9 Treatment of Low-Back Pain (Acute or Sub-Acute Pain) [17, 18]

- In patients with favorable prognosis, reassurance is imperative.
- Physical activity and supervised exercise regimens.
- Bed rest should not be recommended.
- Nonpharmacological therapy that can be used in an acute setting with moderate-quality evidence includes superficial heat, massage, and acupuncture. Low-quality evidence therapies include spinal manipulation.
- Second-line agents include nonsteroidal anti-inflammatory drugs, muscle relaxants, and duloxetine (as co-medications for pain control). Newer guidelines no longer support the use of acetaminophen and tricyclic antidepressants.
- Modalities such as electrotherapy should not be used.

- Medications and other therapies should only be used short term.
- There should be a multidisciplinary approach to treatment.

6.10 Treatment of Inflammatory Back Pain (IBP)

The main target for therapy is to decrease the severity of symptoms and inflammation and to halt the progression to impairment and functional disability. Nonpharmacological therapy includes exercise and patient counselling. Group exercises are favored over home exercises. Treatment of patients suffering from IBP should be tailored to each patient's individual manifestations and general condition. Factors that should be kept in mind include the patient's age, sex, presence of comorbidities, medication interactions, socioeconomic status, severity of symptoms and signs, and his overall prognosis. Certain clinical findings should be considered while formulating a therapeutic plan, such as axial or peripheral symptom predominance and enthesal and extra-articular affection.

If the patient complains of persistent symptoms, NSAIDs are used as first-line pharmacological therapy. In cases where NSAIDs are contraindicated or not tolerated, paracetamol and/or opioids can be used. Disease-modifying anti-rheumatic drugs (DMARDs) such as systemic steroids, sulfasalazine, and methotrexate were not found to be useful in axial predominant disease. However, intra-articular injections in affected sites can be beneficial.

If patients exhibit significantly active disease, anti-TNF agents can be considered. Surgery should be offered to patients suffering from pain that is refractory to all previously mentioned treatment lines. It can also be offered to patients with functional impairment and anatomical damage found on imaging [19]. Spinal corrective osteotomy can be considered in patients suffering from severe deformities and significant functional impairment. Referral to surgery should also be done in AS and acute vertebral fracture cases (Fig. 6.4).

Fig. 6.3 Diagnostic algorithm of low back pain

Fig. 6.4 How to approach a LBP patient in the clinic

6.11 Referral

Consultations to neurosurgery or orthopedics are needed if any of the following symptoms and/or signs occur:

1. Cauda equina syndrome: this should be suspected if the patient complains of typical features like bowel and bladder dysfunction (urinary retention), saddle anesthesia, and bilateral leg weakness and numbness.
2. Spinal cord compression: this should be suspected in cancer patients who have a risk of spinal metastasis. They may present with acute neurologic deficits and need emergent evaluation for surgical decompression or radiation therapy.
3. Progressive or severe neurologic deficits or if any neuromotor deficits that persist after 4 to 6 weeks of conservative therapy: these patients should be referred to a neurologist.
4. Sciatica, sensory deficit, or reflex loss persistent for 4–6 weeks in a patient with positive straight leg raise test, consistent clinical findings, and favorable psychosocial circumstances such as realistic expectations and absence of depression, substance abuse, or excessive somatization.

Acknowledgments The authors would like to thank Dr. Waleed Hafiz and Dr. Rola Hassan for their assistance in the development of this chapter.

Abbreviations

ACPA	Anti-citrullinated protein antibodies
AS	Ankylosing spondylitis
CMC	Carpometacarpal <i>joint</i>
CMV	Cytomegalovirus
DIP	Distal interphalangeal joint
DMARDs	Disease-modifying anti-rheumatic drugs
GI	Gastrointestinal
HIV	Human immunodeficiency virus
HLA	Human leukocyte antigen
IBP	Inflammatory back pain
L	Lumbar vertebrae

LBP	Low-back pain
NSAIDs	Nonsteroidal anti-inflammatory drugs
PIP	Proximal interphalangeal <i>joint</i>
PSIS	Posterior superior iliac spine
PUD	Peptic ulcer disease
RF	Rheumatoid factor
S	Sacral vertebrae

References

1. Balagué F, et al. Non-specific low back pain. *Lancet*. 2012;19(9829):1874.
2. Chou R, Qaseem A, et al. Diagnosis and treatment of low back pain: a joint clinical practice guideline from the American College of Physicians and the American pain society. *Ann Intern Med*. 2007;147(7):478–91.
3. Concannon M, Bridgen A. Lower back pain: a need for thorough assessment. *Pract Nurs*. 2011;22(9)
4. Hoy D, Bain C, Williams G, March L, Brooks P, Blyth F, et al. A systematic review of the global prevalence of low back pain. *Arthritis Rheum*. 2012;64(6):2028–37.
5. Hill JC, Whitehurst DG, Lewis M, Bryan S, Dunn KM, Foster NE, et al. Comparison of stratified primary care management for low back pain with current best practice (STarT Back): a randomised controlled trial. *Lancet*. 2011;378(9802):1560–71.
6. Williams CM, Maher CG, Hancock MJ, McAuley JH, McLachlan AJ, Britt H, et al. Low back pain and best practice care: a survey of general practice physicians. *Arch Intern Med*. 2010;170(3):271–7.
7. Henschke N, Maher CG, Refshauge KM, Herbert RD, Cumming RG, Bleasel J, et al. Prognosis in patients with recent onset low back pain in Australian primary care: inception cohort study. *BMJ*. 2008;337:a171.
8. Bhangle SD, Sapru S, Panush RS. Back pain made simple: an approach based on principles and evidence. *Cleve Clin J Med*. 2009;76(7):393–9.
9. Henschke N, Maher CG, Ostelo RW, De Vet HC, Macaskill P, Irwig L. Red flags to screen for malignancy in patients with low-back pain. *Cochrane Database Syst Rev*. 2013;2:CD008686.
10. Dagenais S, Tricco AC, Haldeman S. Synthesis of recommendations for the assessment and management of low back pain from recent clinical practice guidelines. *Spine J*. 2010;10(6):514–29.
11. Sieper J, Landewé R, et al. New criteria for inflammatory back pain in patients with chronic back pain: a real patient exercise by experts from the assessment of SpondyloArthritis international society (ASAS). *Ann Rheum Dis*. 2009;68(4):784–8.
12. Braun J, Inman R. Clinical significance of inflammatory back pain for diagnosis and screening of

- patients with axial spondyloarthritis. *Ann Rheum Dis.* 2011;69(7):1264–85.
13. Harper BE, John D, et al. Spondyloarthritis: clinical suspicion, diagnosis, and sports. *Curr Sports Med Rep.* 2009;8(1):29–34.
 14. Dincer U, Cakar E, et al. Diagnosis delay in patients with ankylosing spondylitis: possible reasons and proposals for new diagnostic criteria. *Clin Rheumatol.* 2008;27(4):457–62.
 15. Kubiak EN, Moskovich R, et al. Orthopaedic management of ankylosing spondylitis. *J Am Acad Orthop Surg.* 2005;13(4):267–78.
 16. Braun J, Baraliakos X, et al. 2010 update of the ASAS/EULAR recommendations for the management of ankylosing spondylitis. *Ann Rheum Dis.* 2011;70(4):896–904.
 17. Chou R, Huffman LH. Medications for acute and chronic low back pain: a review of the evidence for an American Pain Society/American College of Physicians clinical practice guideline. *Ann Intern Med.* 2008;148(3):247–8.
 18. Perianayagam GR, Newey M, Sell P. NICE guidelines in the management of non-specific back pain in primary care: are they being used? *Bone Joint J.* 2013;95B(SUPP 1):184.
 19. Koes W, et al. An updated overview of clinical guidelines for the management of non-specific low back pain in primary care. *Eur Spine J.* 2010;19(12):2075–94.

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