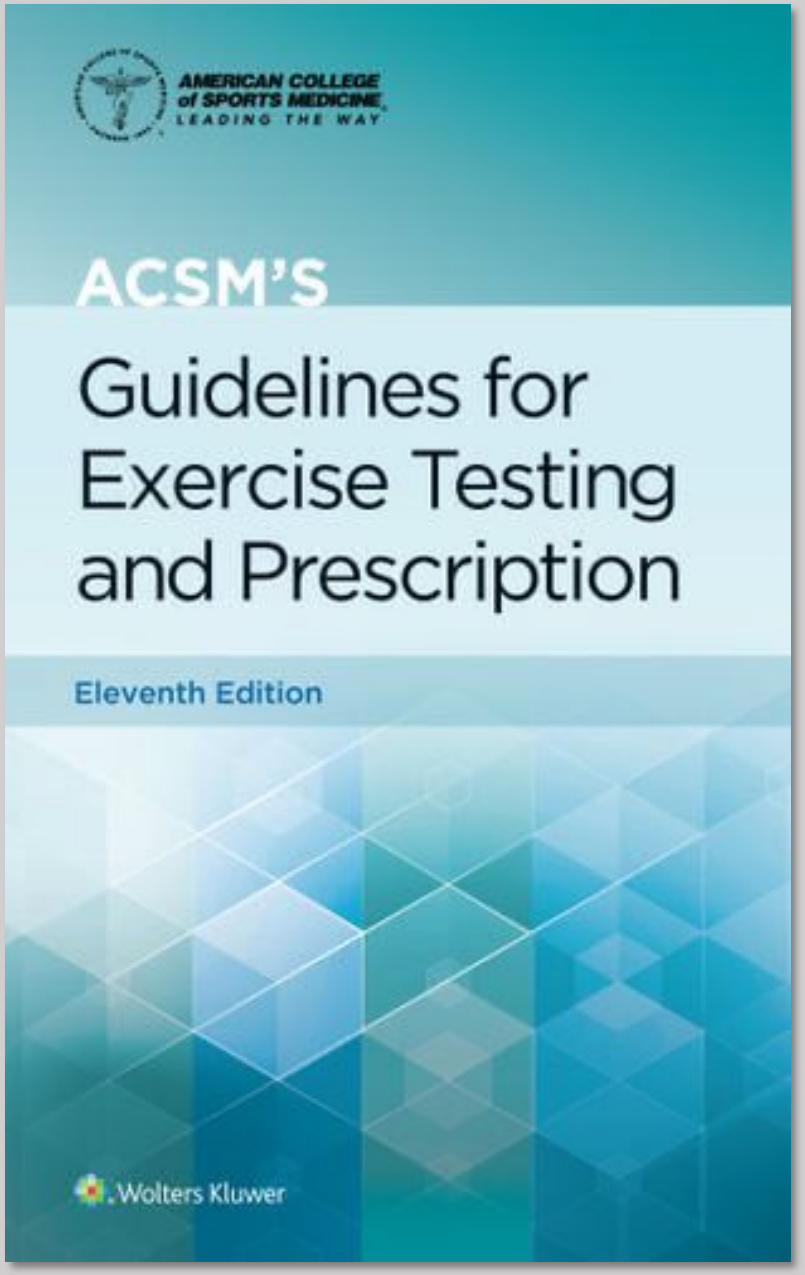

Pilates for
spondylolisthesis
& pars fracture
BREATHE EDUCATION

Learning goals

1. Spondylolisthesis is not a specific cause of back pain
2. Sciatica is complex and multifactorial, and often related to whole-person factors
3. Surgery & all forms of exercise seem to work equally well
4. Guideline-care is reassurance and advice to stay active

Spondylolisthes is not a specific cause of back pain



ACSM's Guidelines

Look up Low Back Pain in the contents

Liguori, G., & American College of Sports Medicine. (2020). ACSM's guidelines for exercise testing and prescription: Lippincott Williams & Wilkins.

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LOW BACK PAIN

Low back pain (LBP) is defined as pain, muscle tension, or stiffness localized below the rib margin and above the inferior gluteal folds, with or without leg pain (36,37).

Liguori, G., & American College of Sports Medicine. (2020). ACSM's guidelines for exercise testing and prescription: Lippincott Williams & Wilkins.


You are here
Rib margin
Gluteal fold

Is this LBP?

Is this LBP?

Is this LBP?

Is this LBP?

Is this LBP?

Specific LBP

Individuals with LBP can be classified into one of three broad categories: (a) LBP potentially associated with another specific spinal cause (*e.g.*, cancer, fracture, infection, ankylosing spondylitis, or cauda equina syndrome); (b) LBP potentially associated with radiculopathy or spinal stenosis; and (c) and nonspecific LBP (LBP with no known pathoanatomical cause), which encompass over 85% of all cases (29).

Nonspecific LBP

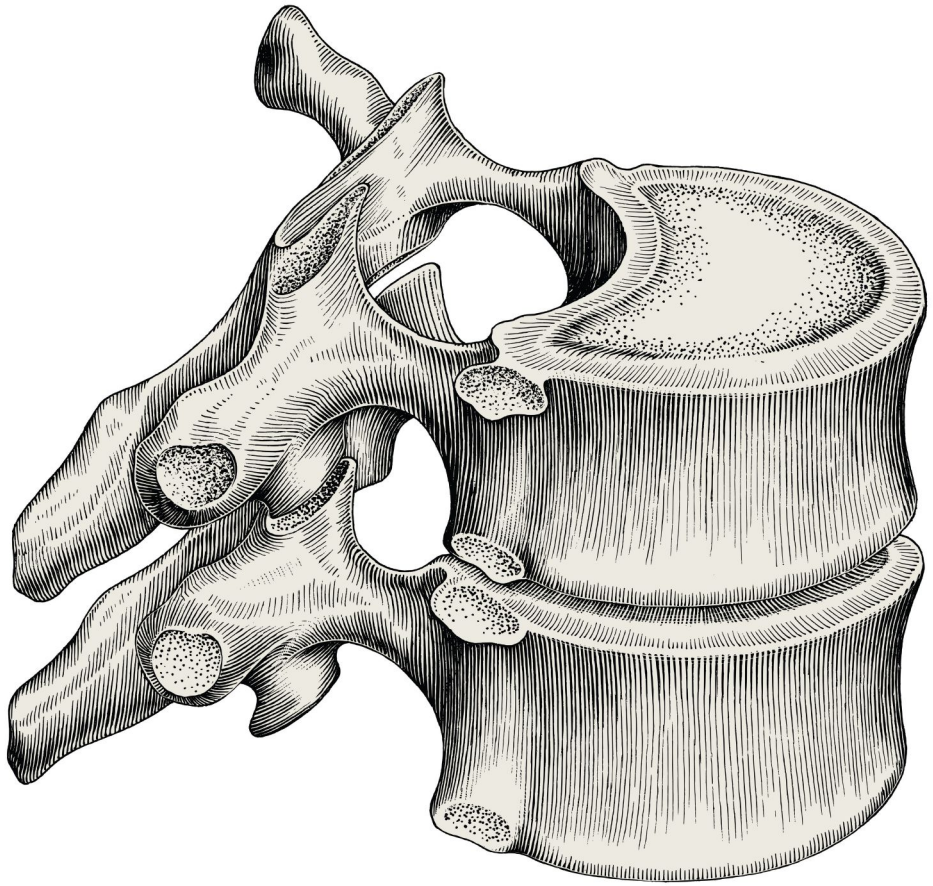
Liguori, G., & American College of Sports Medicine. (2020). ACSM's guidelines for exercise testing and prescription: Lippincott Williams & Wilkins.

Spondylosis

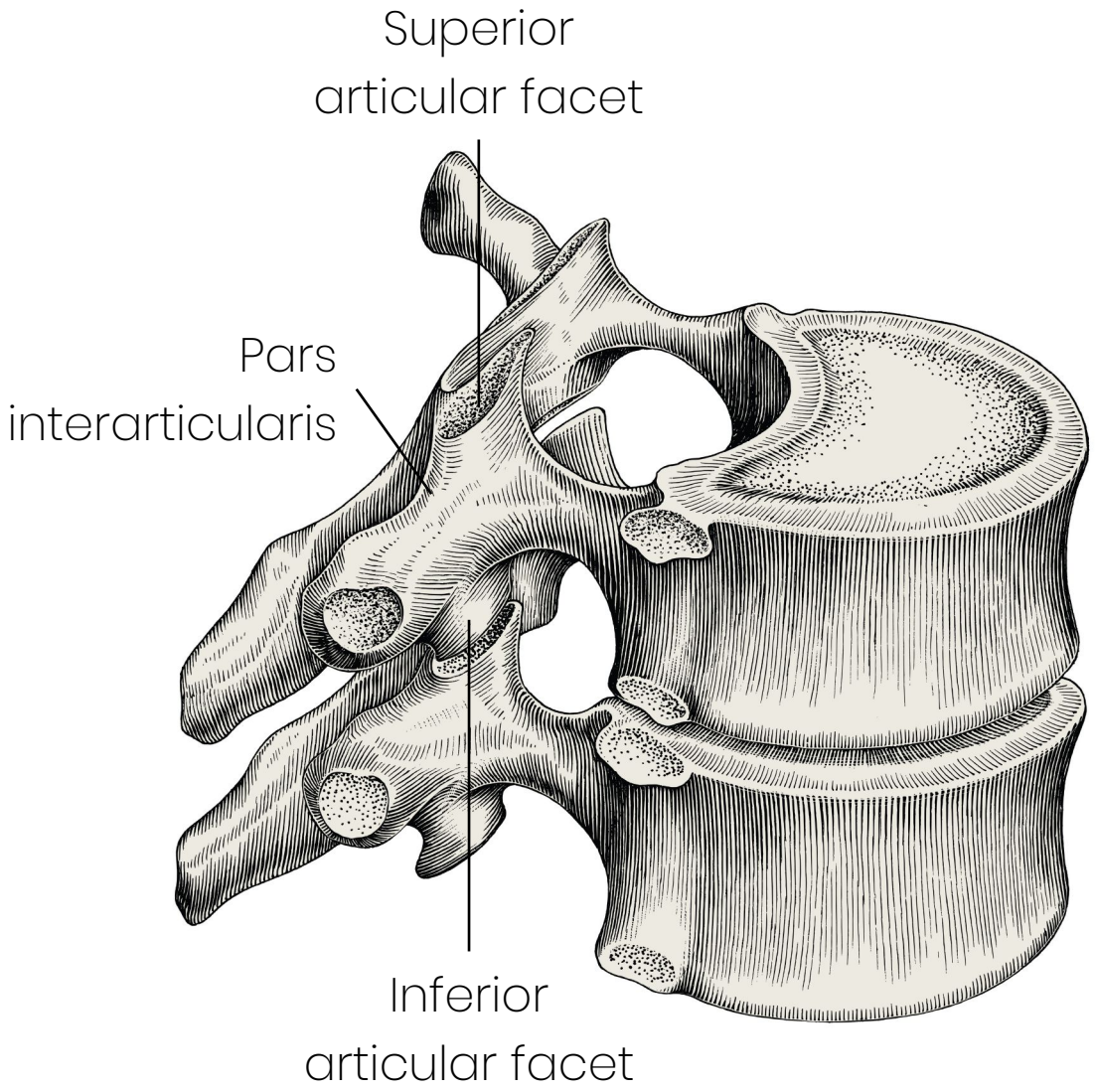
Spondylo = vertebra

Osis = abnormal state or disease

Spondylosis = general umbrella term for conditions of the spine



Pars fracture



Superior = Above

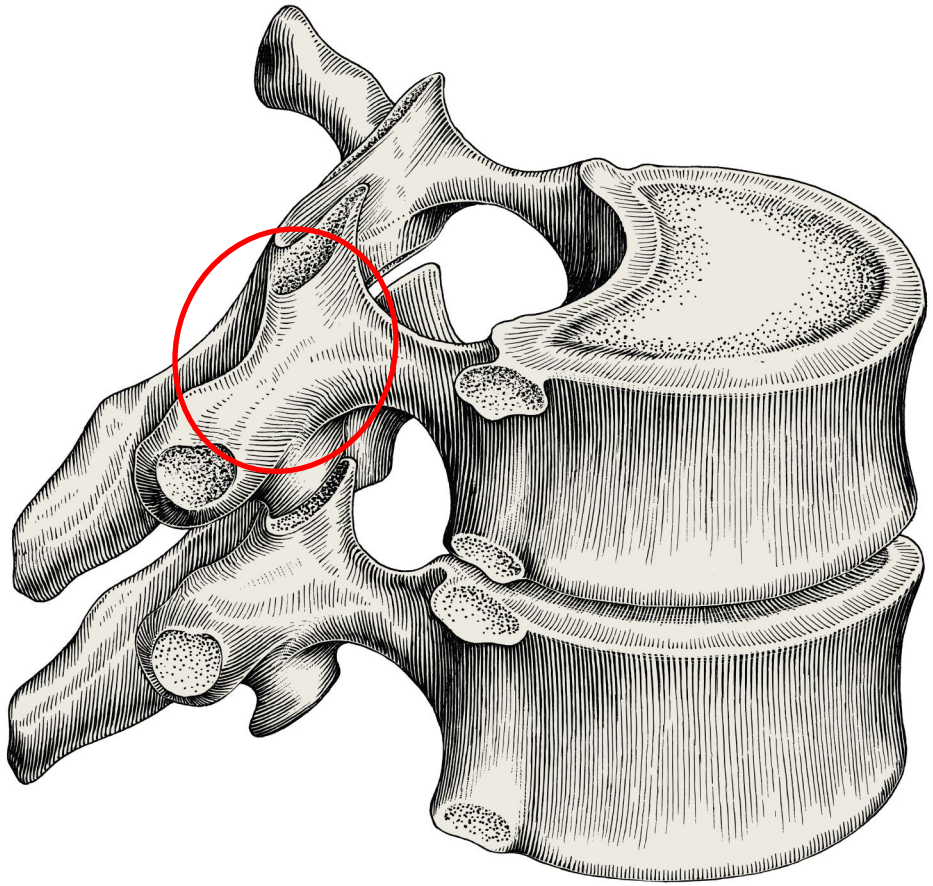
Articulation = joint

Facet = face

Inferior = below

Pars = part

Inter = between



Pars interarticularis

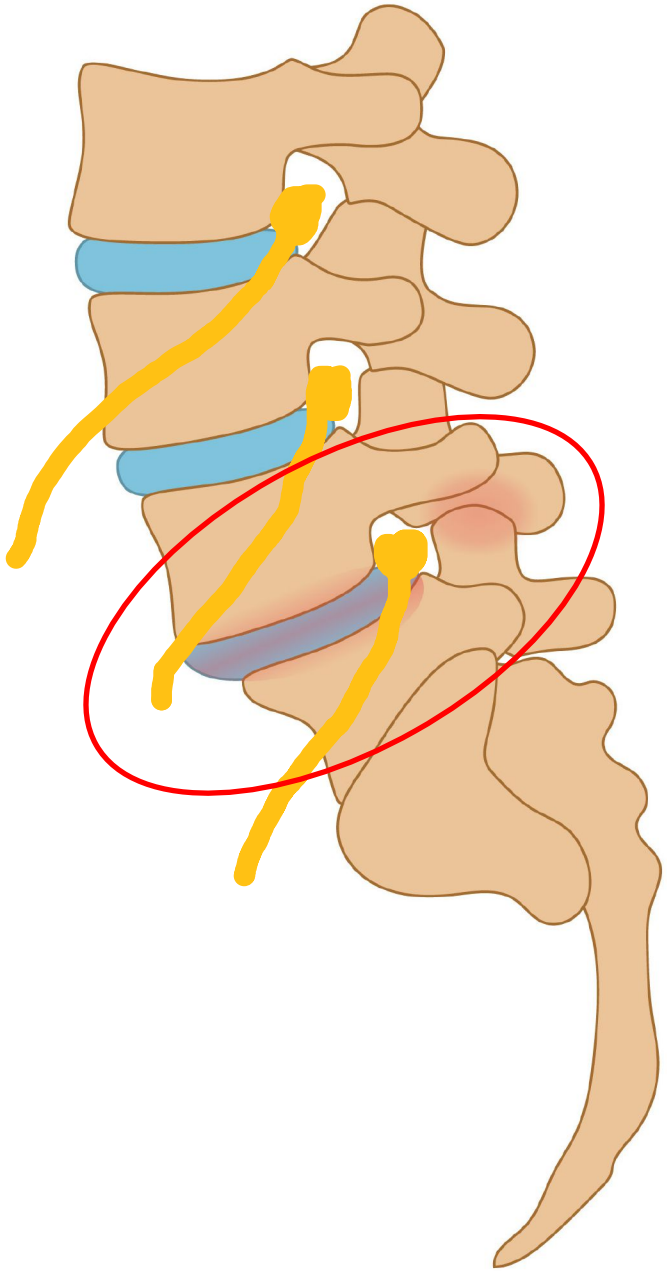
Literally – the part between the joints

Pars interarticularis fracture

- Aka pars defect
- Aka spondylolysis

Spondylo = vertebra

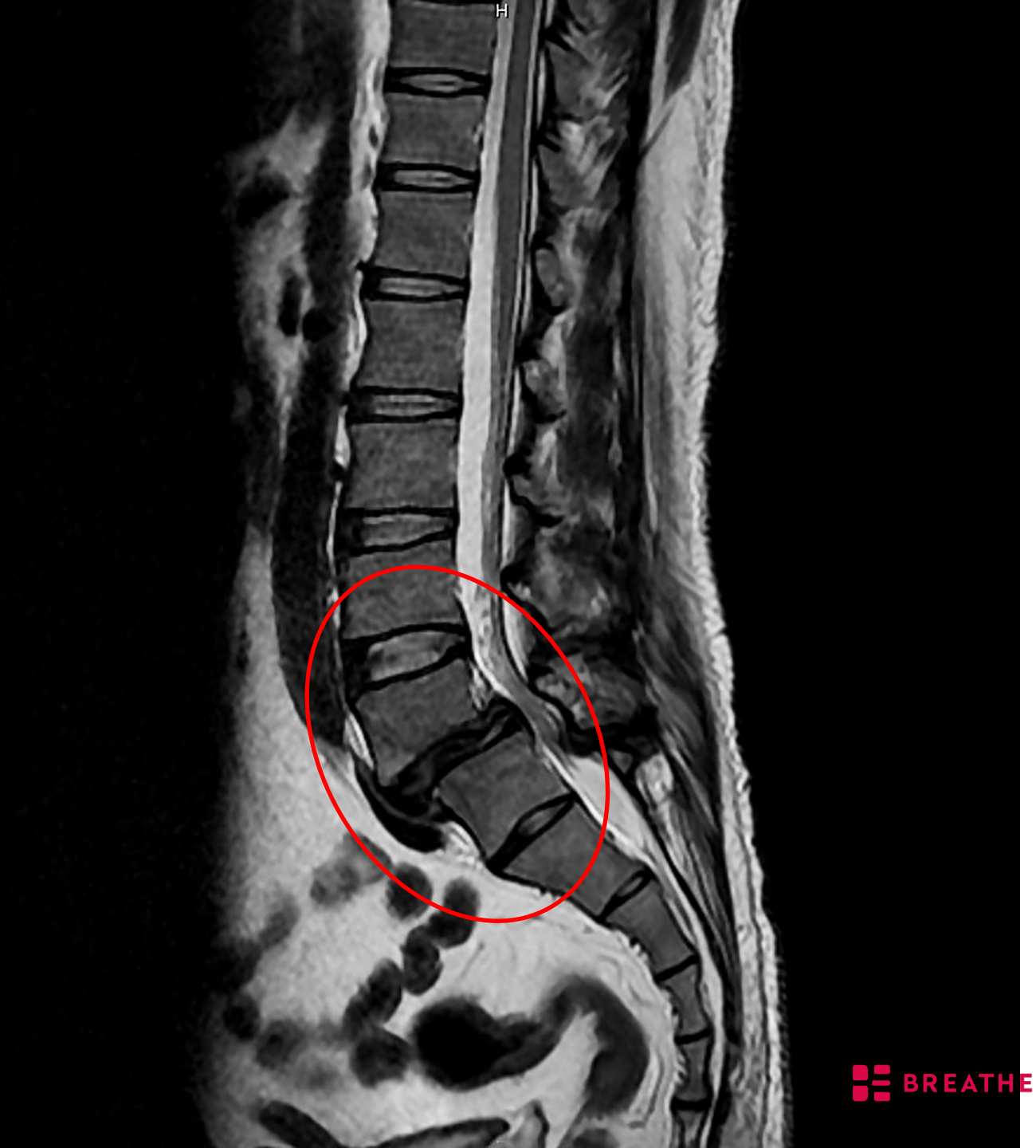
Lysis = loosening



Spondylolisthesis

Forward slippage of a vertebra relative to the one below

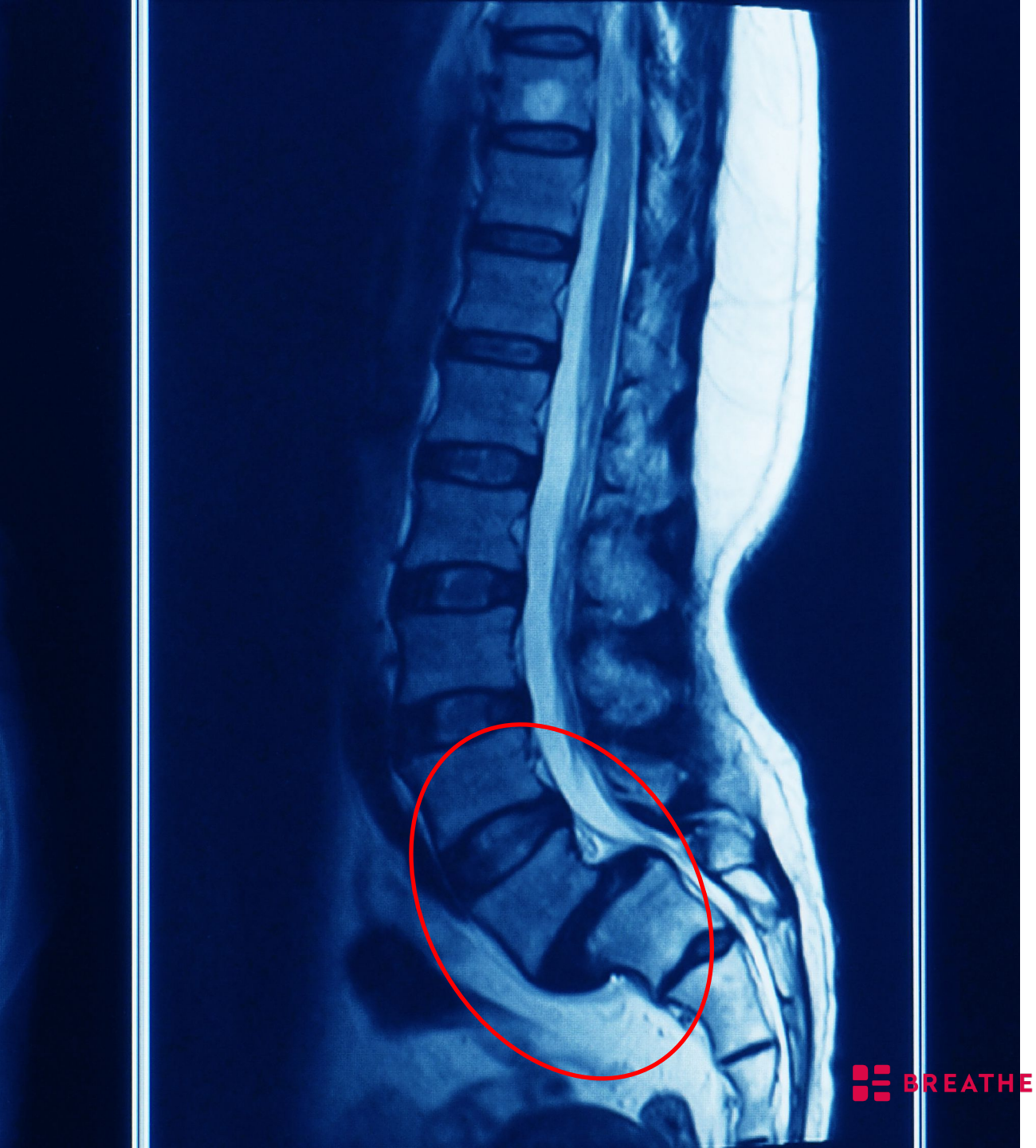
Aka “spondy”



Spondylolisthesis

Spondylo = vertebra

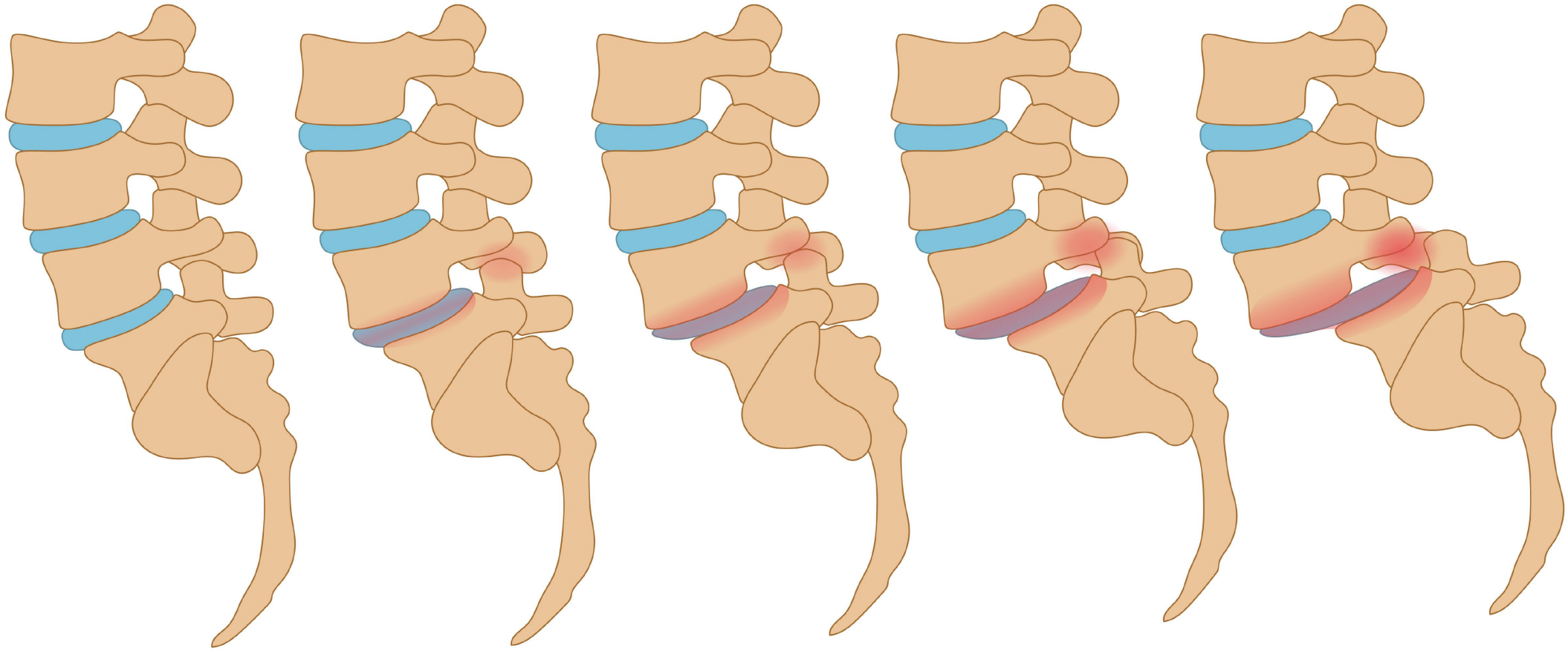
Listhesis = slippage



Spondylolisthesis

- Can start as a pars fracture
- Most pars fractures never progress to spondylolisthesis

Grades of spondylolisthesis



None | Grade 1 = 25% | Grade 2 = 25-50% | Grade 3 = 50-75% | Grade 4 >75%

Imaging Finding	Age (yr)						
	20	30	40	50	60	70	80
Disk degeneration	37%	52%	68%	80%	88%	93%	96%
Disk signal loss	17%	33%	54%	73%	86%	94%	97%
Disk height loss	24%	34%	45%	56%	67%	76%	84%
Disk bulge	30%	40%	50%	60%	69%	77%	84%
Disk protrusion	29%	31%	33%	36%	38%	40%	43%
Annular fissure	19%	20%	22%	23%	25%	27%	29%
Facet degeneration	4%	9%	18%	32%	50%	69%	83%
Spondylolisthesis	3%	5%	8%	14%	23%	35%	50%

Spondylolisthesis is increasingly common with age in pain-free people

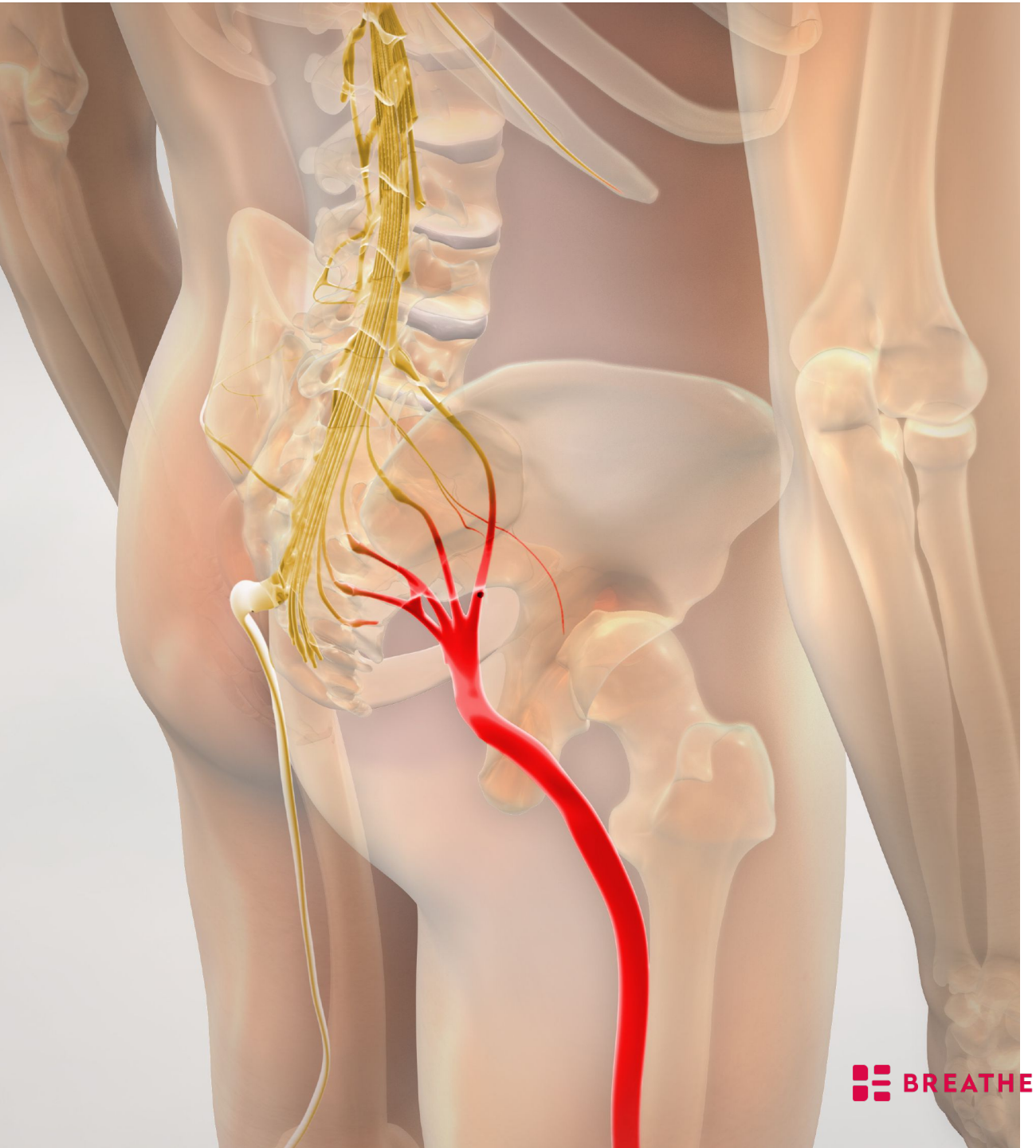
Brinjikji, W., Luetmer, P. H., Comstock, B., Bresnahan, B. W., Chen, L., Deyo, R., . . . James, K. (2015). Systematic literature review of imaging features of spinal degeneration in asymptomatic populations. American Journal of Neuroradiology, 36(4), 811-816. Retrieved from https://be-research-papers.s3.amazonaws.com/Back+pain/4.+Brinjikji-2015-asymptomatic.pdf

chanical function of the lower lumbar spine.[41]

Findings not directly related to the disc such as spondylolisthesis and central canal stenosis demonstrated no association with low back pain in our study. These findings are consistent with what has been previously reported in the literature. Spondylolisthesis is also consistently not associated with low back pain in

Spondylolisthesis & central canal stenosis have **no association** with back pain

Brinjikji, W., Diehn, F. E., Jarvik, J. G., Carr, C. M., Kallmes, D. F., Murad, M. H., & Luetmer, P. H. (2015). MRI Findings of Disc Degeneration are More Prevalent in Adults with Low Back Pain than in Asymptomatic Controls: A Systematic Review and Meta-Analysis. AJNR Am J Neuroradiol, 36(12), 2394-2399. doi:10.3174/ajnr.A4498 https://be-lecture-notes.s3.amazonaws.com/MRI%20Findings%20of%20Disc%20Degeneration%20are%20Mor-2015.pdf



But it may have an association with leg pain aka sciatica

Ishimoto, Y., Yoshimura, N., Muraki, S., Yamada, H., Nagata, K., Hashizume, H., . . . Tanaka, S. (2017). Association of lumbar spondylolisthesis with low back pain and symptomatic lumbar spinal stenosis in a population-based cohort: the Wakayama Spine Study. Spine, 42(11), E666-E671. https://be-lecture-notes.s3.amazonaws.com/ishimoto2016.pdf

Self-test

- What is low back pain?
- What is spondylosis?
- What is pars interarticularis fracture?
- What is spondylolisthesis?
- Does spondylolisthesis cause back pain?
- Does it cause sciatica?

Sciatica is complex & multifactorial and often related to whole-person factors

Sciatica is complex & multifactorial

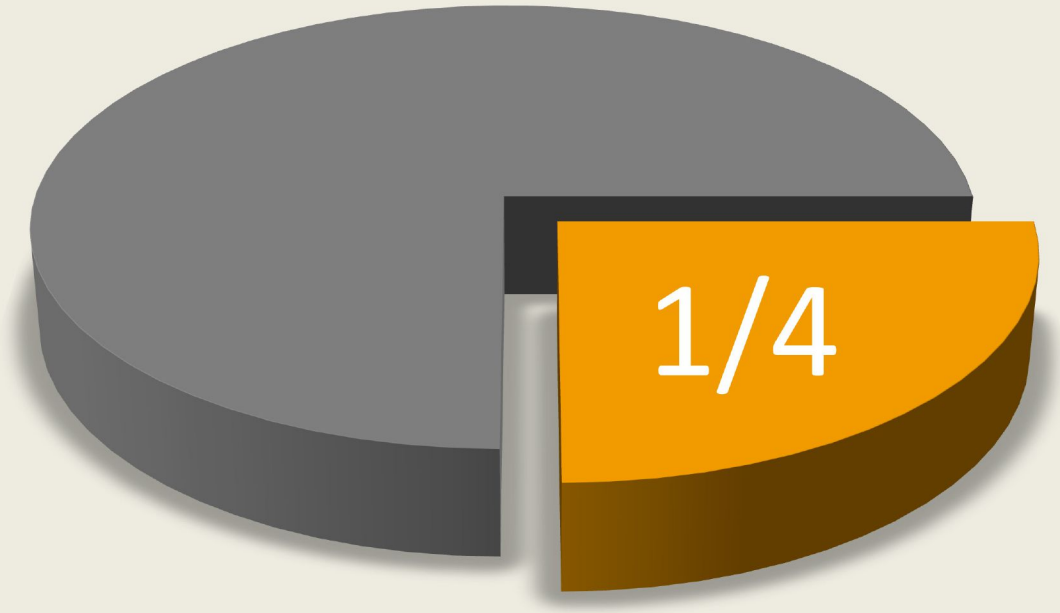
- Inflammation is important
- Peripheral & /or central sensitization is usually present
- Psychosocial factors are important
- Nerve root compression can contribute but compression alone is not enough to cause sciatica

Mechanical compression of the nerve root is **not** the main factor in sciatica

Pressure on a nerve is probably not enough to cause symptoms

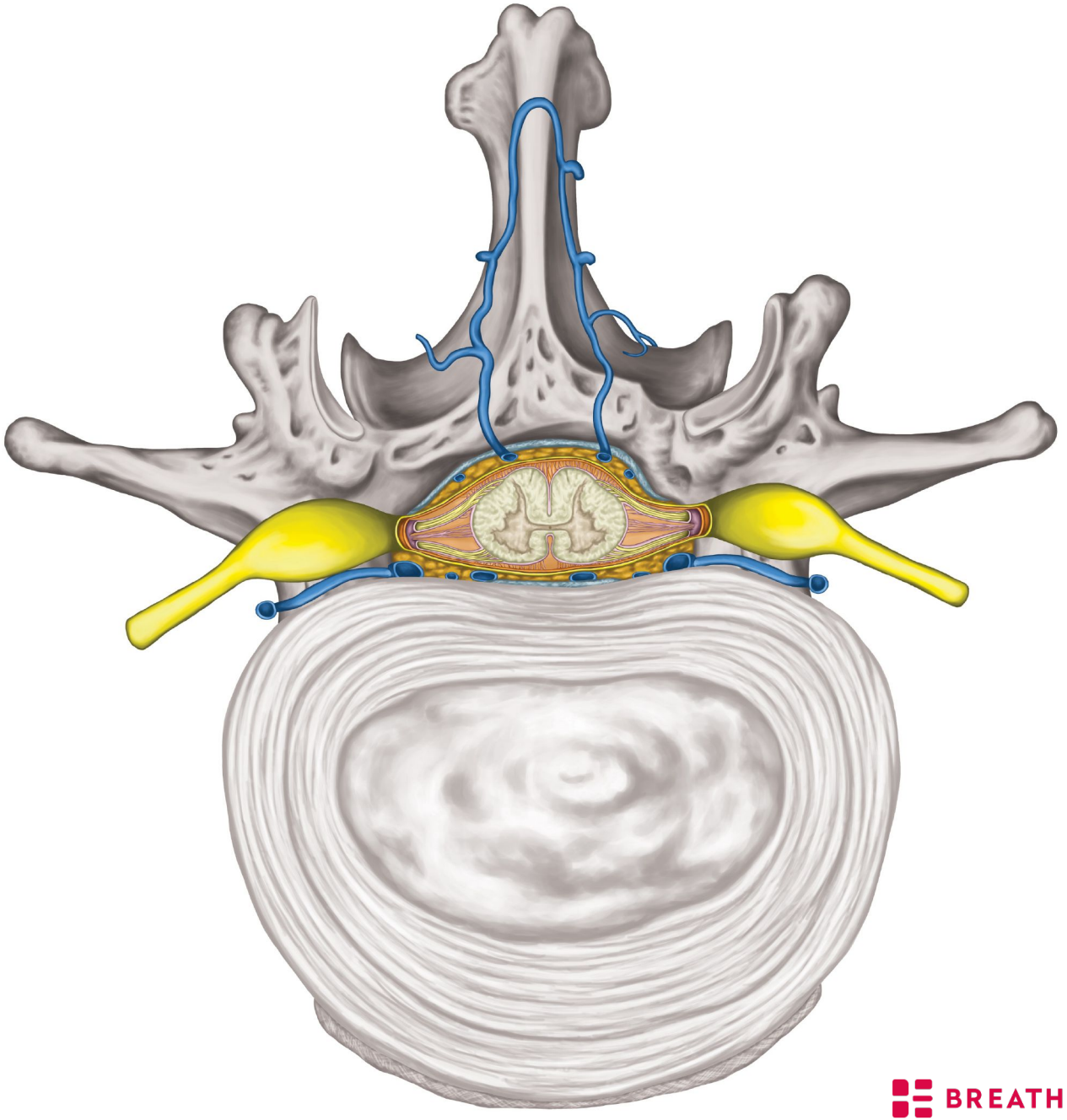
You also need inflammation

Stafford, M., Peng, P., & Hill, D. (2007). Sciatica: a review of history, epidemiology, pathogenesis, and the role of epidural steroid injection in management. British journal of anaesthesia, 99(4), 461-473. https://be-research-papers.s3.amazonaws.com/Diploma+lecture+research+papers/Lecture+17+Sciatica+pt+2/Stafford-2007-Sciatica_+a+review+of+history%2C+e.pdf



24% of asymptomatic people have spinal cord compression

Smith, S. S., Stewart, M. E., Davies, B. M., & Kotter, M. R. (2020). The prevalence of asymptomatic and symptomatic spinal cord compression on magnetic resonance imaging: a systematic review and meta-analysis. Global Spine Journal, 2192568220934496. https://be-research-papers.s3.amazonaws.com/Diploma+lecture+research+papers/Lecture+17+Sciatica+pt+2/Smith-2020-The+prevalence+of+asymptomatic+and.pdf



Inflammation

Inflammation can increase pressure on the nerve root even if nothing is touching it

Inflammatory chemicals like histamines & cytokines **increase sensitivity of the pain system**

Stafford, M., Peng, P., & Hill, D. (2007). Sciatica: a review of history, epidemiology, pathogenesis, and the role of epidural steroid injection in management. British journal of anaesthesia, 99(4), 461-473. https://be-research-papers.s3.amazonaws.com/Diploma+lecture+research+papers/Lecture+17+Sciatica+pt+2/Stafford-2007-Sciatica_+a+review+of+history%2C+e.pdf

Peripheral sensitization

Your peripheral neurons are primed to fire more easily

Stimuli that are normally innocuous become painful

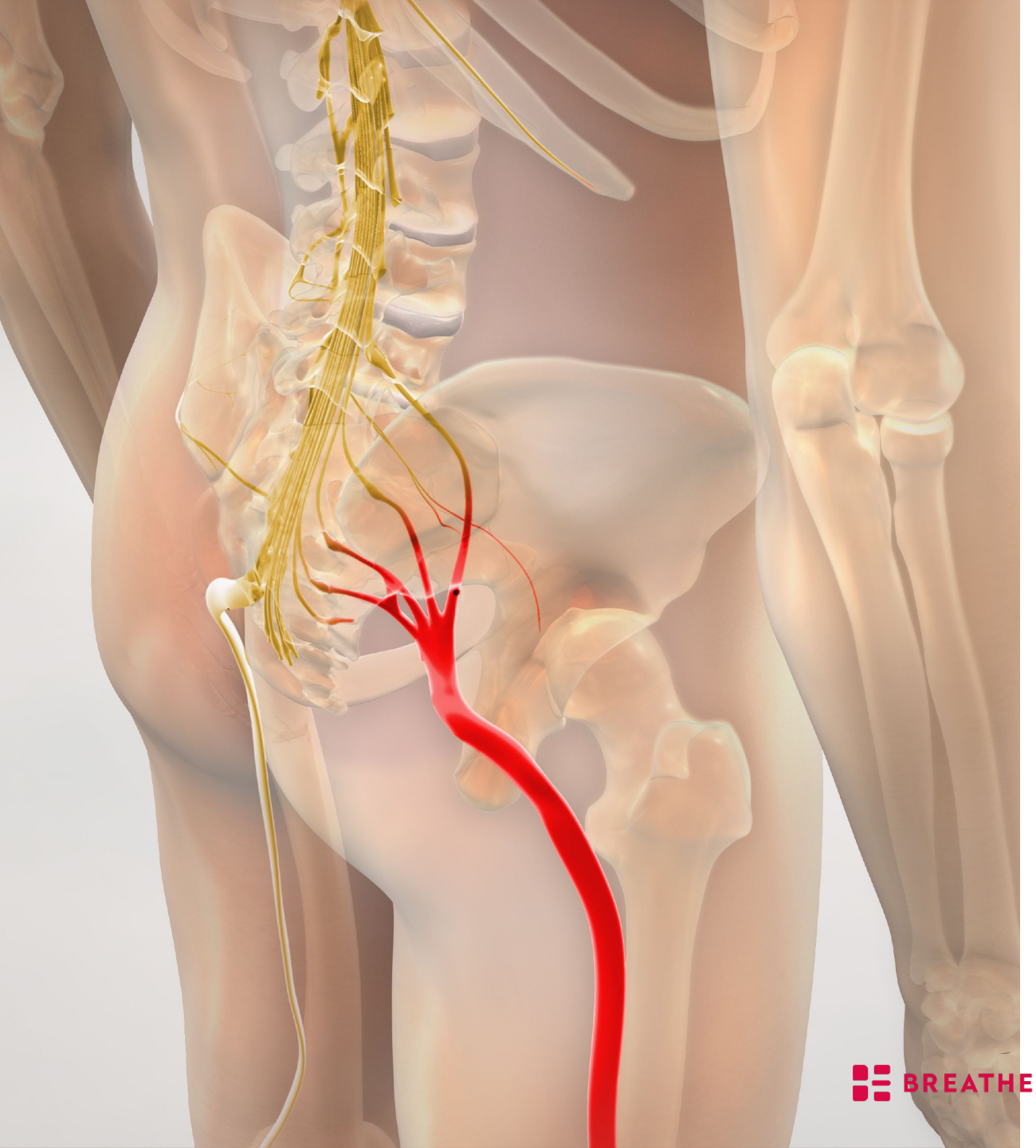
Inflammation causes local tissue to become more sensitive

Central sensitization

Neurons in your brain and spinal cord are primed to fire more easily

Stimuli that are normally innocuous become more painful

Central sensitization can cause increased pain sensitivity in multiple body regions



Increased firing rate of neurons

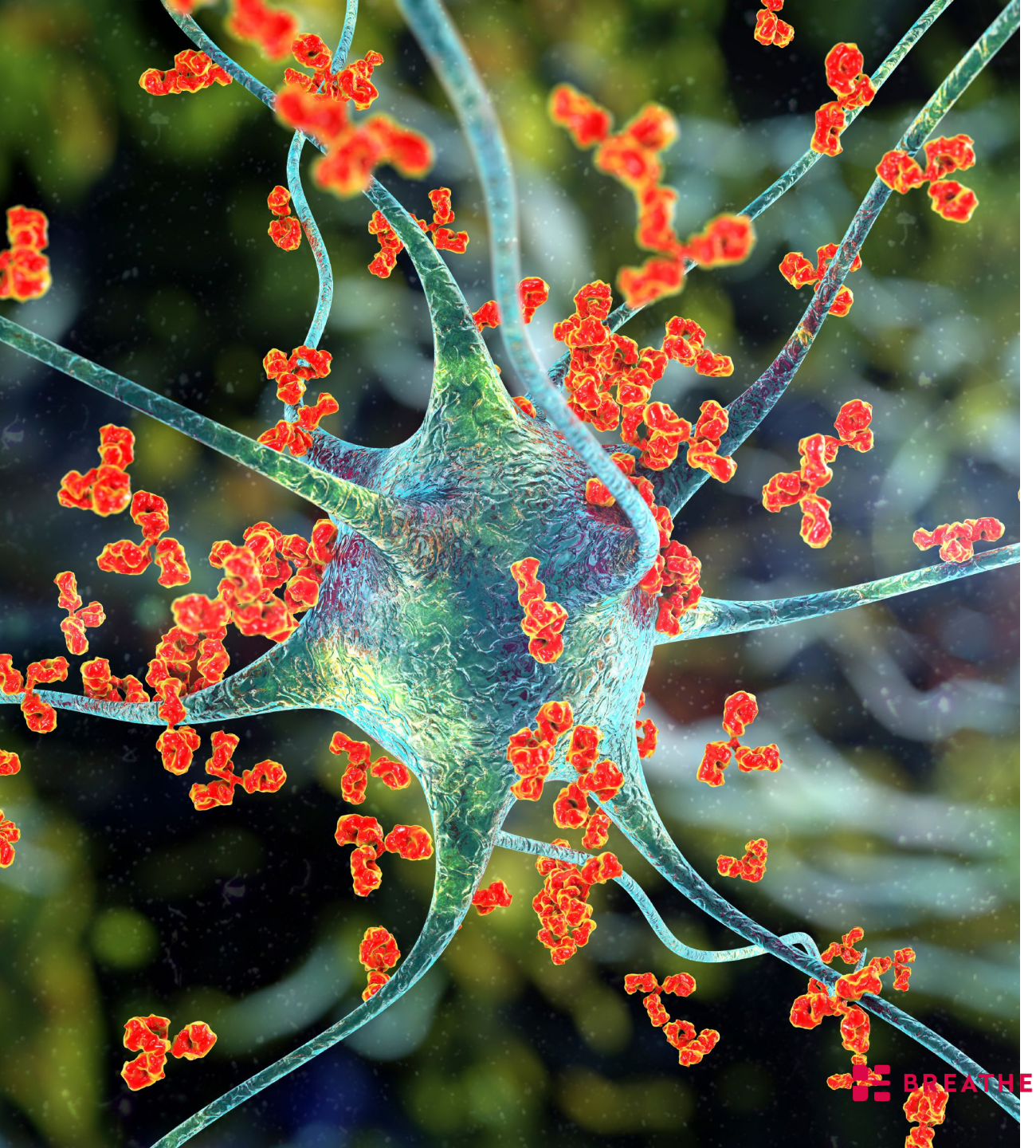
Vernon, H. (2012). What is different about spinal pain? Chiropractic & manual therapies, 20(1), 22-22. doi:10.1186/2045-709X-20-22 https://be-research-papers.s3.amazonaws.com/Diploma+lecture+research+papers/Lecture+17+Sciatica+pt+2/Vernon-2012-What+is+different+about+spinal+pai.pdf

Increased responsiveness of neurons to mechanical input

Vernon, H. (2012). What is different about spinal pain? Chiropractic & manual therapies, 20(1), 22-22. doi:10.1186/2045-709X-20-22 https://be-research-papers.s3.amazonaws.com/Diploma+lecture+research+papers/Lecture+17+Sciatica+pt+2/Vernon-2012-What+is+different+about+spinal+pai.pdf

Lowered threshold to excitation by non-noxious inputs

Vernon, H. (2012). What is different about spinal pain? Chiropractic & manual therapies, 20(1), 22-22. doi:10.1186/2045-709X-20-22 https://be-research-papers.s3.amazonaws.com/Diploma+lecture+research+papers/Lecture+17+Sciatica+pt+2/Vernon-2012-What+is+different+about+spinal+pai.pdf



Immune attack on spinal nerve tissue

Stafford, M., Peng, P., & Hill, D. (2007). Sciatica: a review of history, epidemiology, pathogenesis, and the role of epidural steroid injection in management. British journal of anaesthesia, 99(4), 461-473. https://be-research-papers.s3.amazonaws.com/Diploma+lecture+research+papers/Lecture+17+Sciatica+pt+2/Stafford-2007-Sciatica_+a+review+of+history%2C+e.pdf

Higher levels of ongoing discharge in spinal neurons

Vernon, H. (2012). What is different about spinal pain? Chiropractic & manual therapies, 20(1), 22-22. doi:10.1186/2045-709X-20-22 https://be-research-papers.s3.amazonaws.com/Diploma+lecture+research+papers/Lecture+17+Sciatica+pt+2/Vernon-2012-What+is+different+about+spinal+pai.pdf

What causes central sensitization?

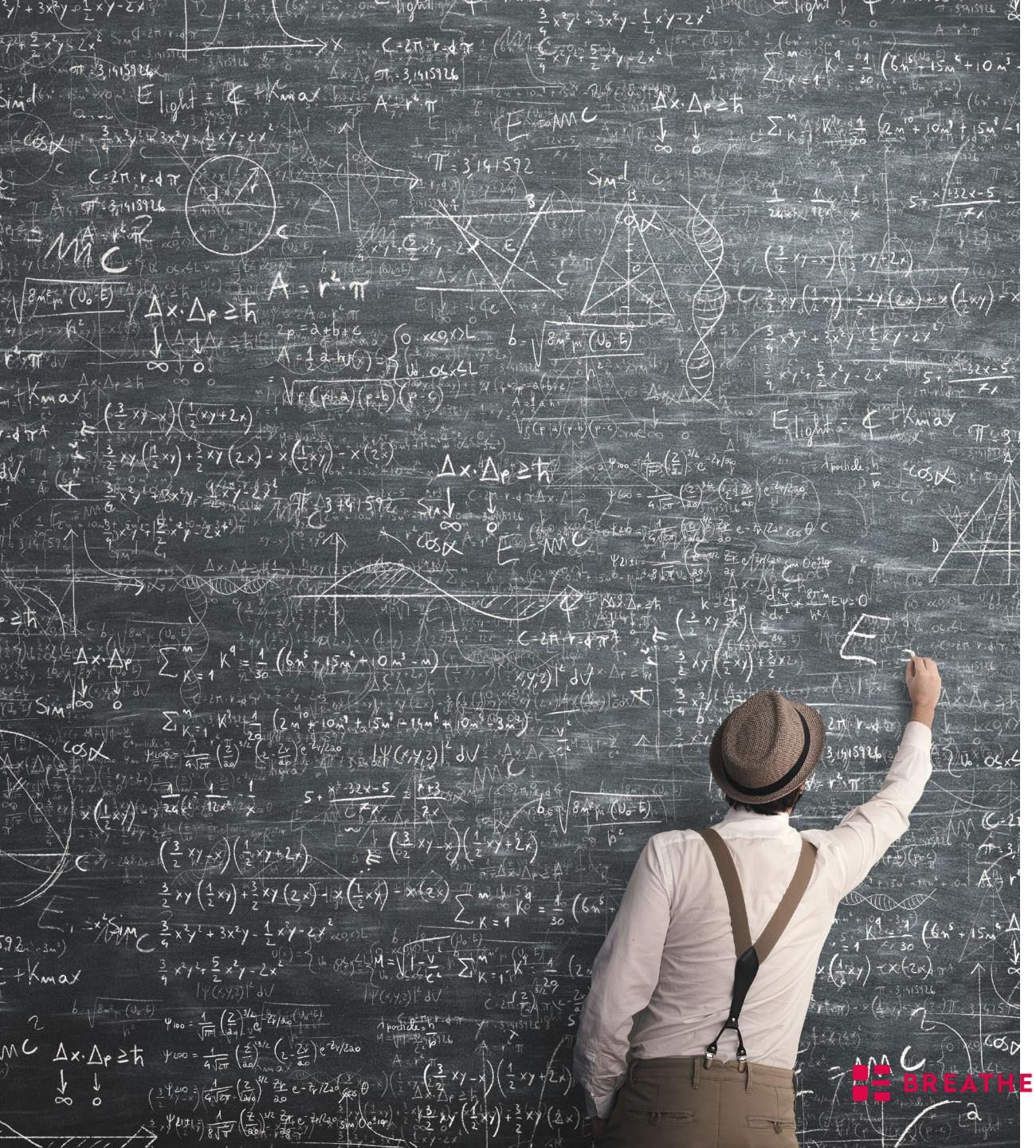
- Genetic predisposition
- Psychosocial stressors
- Neuroimmune system changes including inflammation

Harte, S. E., Harris, R. E., & Clauw, D. J. (2018). The neurobiology of central sensitization. Journal of Applied Biobehavioral Research, 23(2), e12137. https://dip2022.s3.amazonaws.com/Lecture%2017/Harte-2018-The%20neurobiology%20of%20central%20sensiti.pdf

Psychosocial factors predict long-term outcomes in sciatica

Konstantinou, K., Dunn, K. M., Ogollah, R., Lewis, M., van der Windt, D., Hay, E. M., & team, A. s. (2017). Prognosis of sciatica and back-related leg pain in primary care: the ATLAS cohort. The Spine Journal. https://be-research-papers.s3.amazonaws.com/Diploma+lecture+research+papers/Lecture+17+Sciatica+pt+2/Konstantinou-2017-Prognosis+of+sciatica+and+ba.pdf

Moss-Morris, R., Weinman, J., Petrie, K., Horne, R., Cameron, L., & Buick, D. (2002). The revised illness perception questionnaire (IPQ-R). Psychology and health, 17(1), 1-16. https://be-research-papers.s3.amazonaws.com/Diploma+lecture+research+papers/Lecture+17+Sciatica+pt+2/Moss-Morris-2002-The+revised+illness+perceptio.pdf



Bottom line:

It's **complicated**

It's not just mechanical pressure on a nerve root

BREATHE EDUCATION

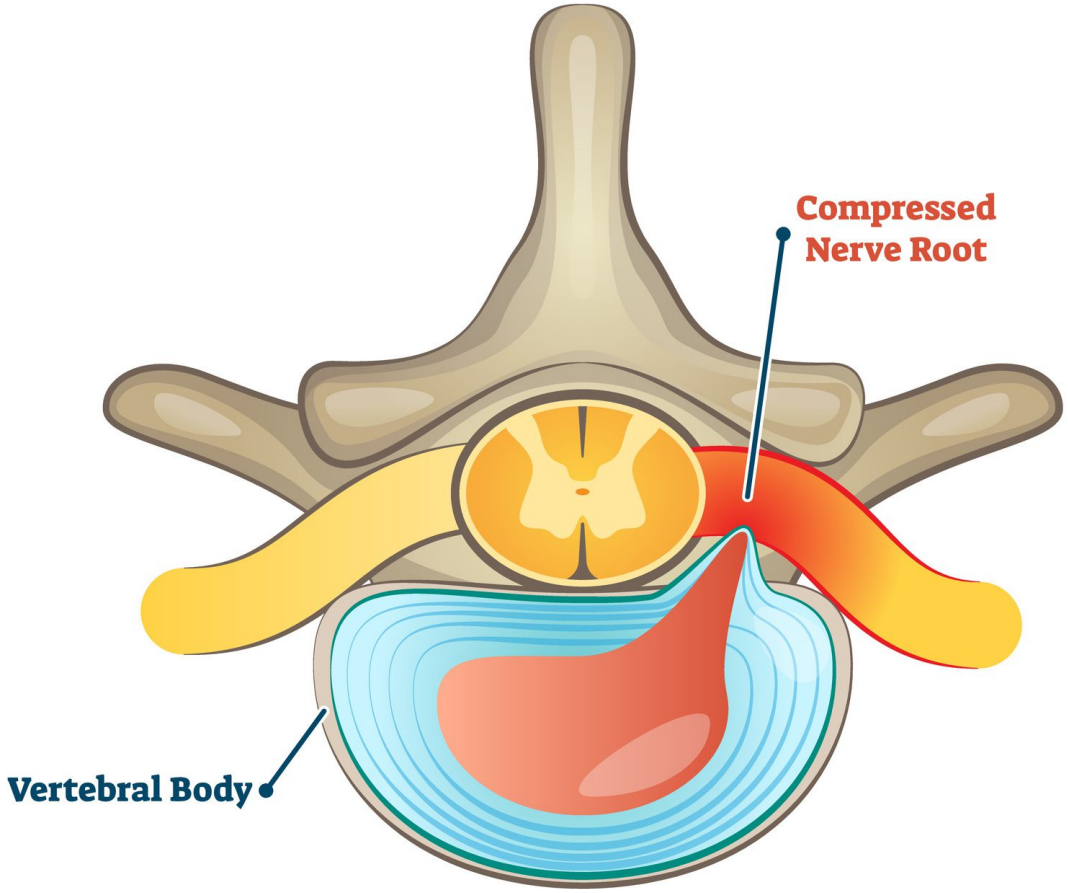
Sciatica is caused by a combination of

- Inflammation
- Nerve root compression
- Peripheral & /or central sensitization
- Psychosocial factors
- Nerve compression alone is not enough to cause sciatica

Self-test

- What causes sciatica?
- Is compression of a nerve root sufficient to cause sciatica?
- What are some of the structural diagnoses associated with sciatica and LBP?
- What is central sensitization?
- What contributes to central sensitization?

Surgery & all forms of exercise seem to work equally well

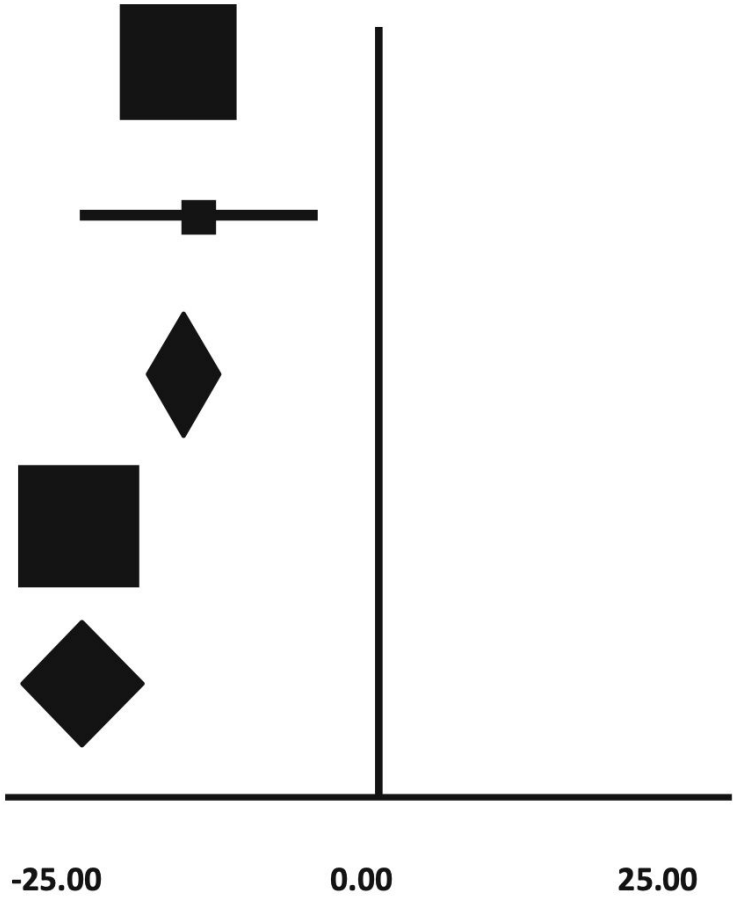


Nerve root compression predicts **better** 1-year outcomes

el Barzouhi, A., Verwoerd, A. J., Peul, W. C., Verhagen, A. P., Lycklama à Nijeholt, G. J., Van der Kallen, B. F., . . . Vleggeert-Lankamp, C. L. (2016). Prognostic value of magnetic resonance imaging findings in patients with sciatica. Journal of Neurosurgery: Spine, 24(6), 978-985. https://be-research-papers.s3.amazonaws.com/Diploma+lecture+research+papers/Lecture+17+Sciatica+pt+2/el+Barzouhi-2016-Prognostic+value+of+magnetic.pdf

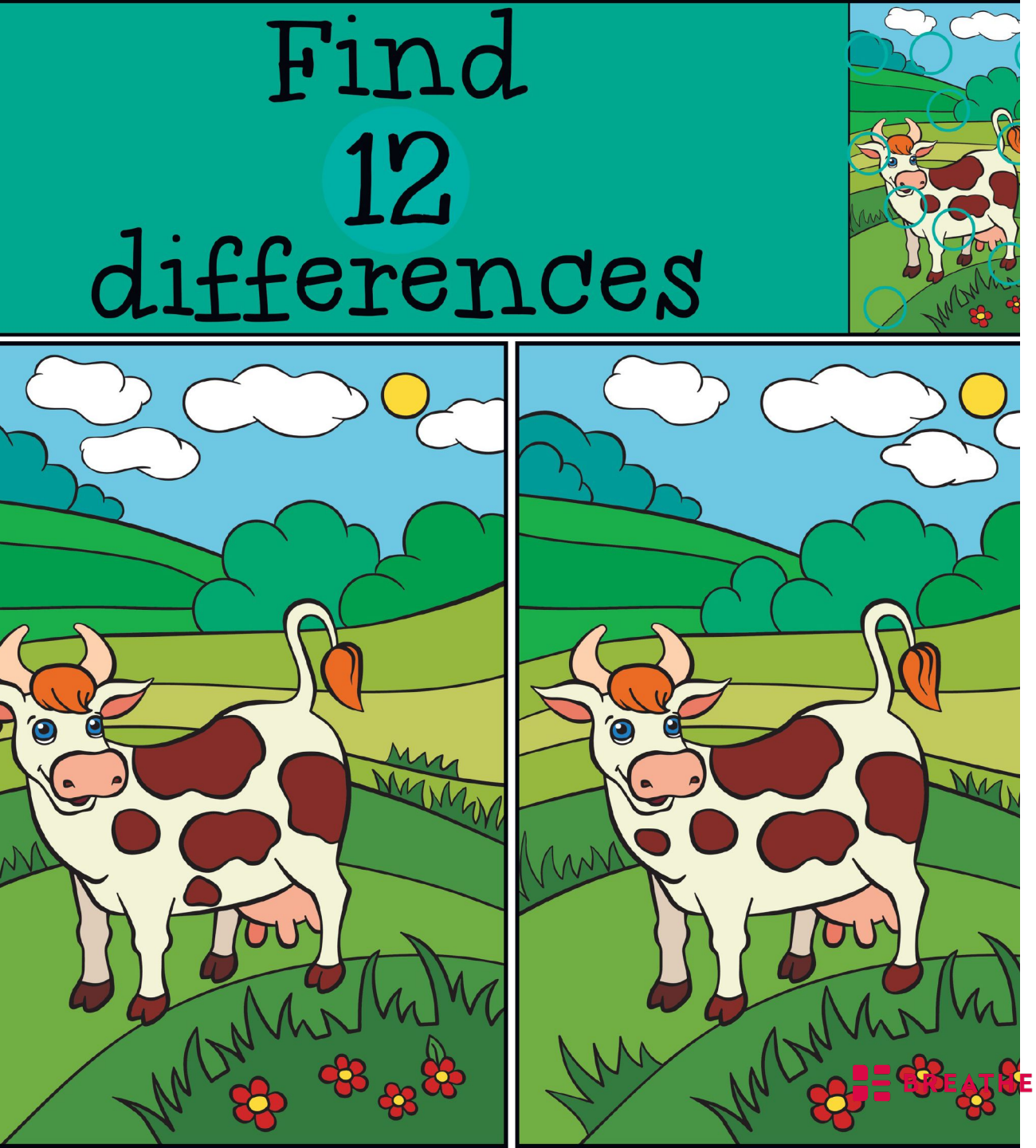
Moderate–severe motor deficit recovers fully within 12 months in 80% of people

Overdevest, G. M., Vleggeert-Lankamp, C. L., Jacobs, W. C., Brand, R., Koes, B. W., Peul, W. C., & Group, L.-T. H. S. I. P. S. (2014). Recovery of motor deficit accompanying sciatica—subgroup analysis of a randomized controlled trial. The Spine Journal, 14(9), 1817-1824. https://be-research-papers.s3.amazonaws.com/Diploma+lecture+research+papers/Lecture+17+Sciatica+pt+2/Overdevest-2014-Recovery+of+motor+deficit+acco.pdf



For sciatica with spondylolisthesis surgery is better than exercise by **17–25** / 100

Fernandez, M., Ferreira, M. L., Refshauge, K. M., Hartvigsen, J., Silva, I. R., Maher, C. G., . . . Ferreira, P. H. (2016). Surgery or physical activity in the management of sciatica: a systematic review and meta-analysis. European Spine Journal, 25(11), 3495-3512. https://be-research-papers.s3.amazonaws.com/Diploma+lecture+research+papers/Lecture+17+Sciatica+pt+2/Fernandez-2016-Surgery+or+physical+activity+in.pdf



Minimum clinically important difference

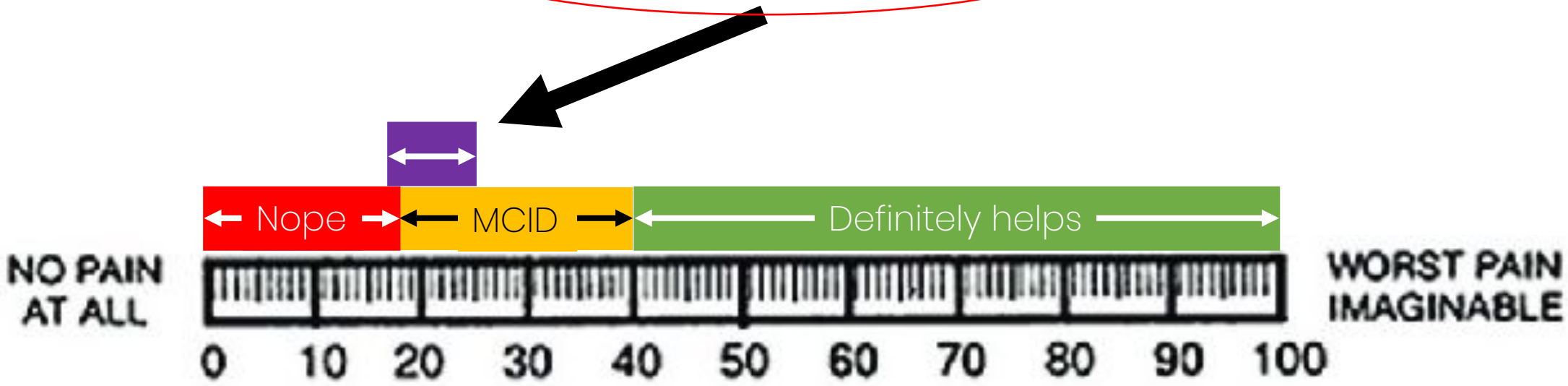
Aka MCID

The smallest change patients identify as meaningful

On a 1-100 VAS scale, MCID varies from **18-40**

Olsen, M. F., Bjerre, E., Hansen, M. D., Hilden, J., Landler, N. E., Tendal, B., & Hróbjartsson, A. (2017). *Pain relief that matters to patients: systematic review of empirical studies assessing the minimum clinically important difference in acute pain*. BMC Medicine, 15(1), 35. https://be-research-papers.s3.amazonaws.com/Diploma+lecture+research+papers/Lecture+17+Sciatica+pt+2/Olsen-2017-Pain+relief+that+matters+to+patient.pdf

Surgery vs exercise for sciatica from spondylolisthesis



Olsen, M. F., Bjerre, E., Hansen, M. D., Hilden, J., Landler, N. E., Tendal, B., & Hróbjartsson, A. (2017). Pain relief that matters to patients: systematic review of empirical studies assessing the minimum clinically important difference in acute pain. BMC Medicine, 15(1), 35. https://be-research-papers.s3.amazonaws.com/Diploma+lecture+research+papers/Lecture+17+Sciatica+pt+2/Olsen-2017-Pain+relief+that+matters+to+patient.pdf

No difference between surgery and exercise for motor deficit

Overdevest, G. M., Vleggeert-Lankamp, C. L., Jacobs, W. C., Brand, R., Koes, B. W., Peul, W. C., & Group, L.-T. H. S. I. P. S. (2014). Recovery of motor deficit accompanying sciatica—subgroup analysis of a randomized controlled trial. The Spine Journal, 14(9), 1817-1824. https://be-research-papers.s3.amazonaws.com/Diploma+lecture+research+papers/Lecture+17+Sciatica+pt+2/Overdevest-2014-Recovery+of+motor+deficit+acco.pdf

For high grade spondylolisthesis identical results from surgery & exercise

Xue, X., Wei, X., & Li, L. (2016). Surgical versus nonsurgical treatment for high-grade spondylolisthesis in children and adolescents: a systematic review and meta-analysis. Medicine, 95(11). https://be-research-papers.s3.amazonaws.com/Diploma+lecture+research+papers/Lecture+17+Sciatica+pt+2/Xue-2016-Surgical+versus+nonsurgical+treatment.pdf

For spondylolisthesis **no difference** between stabilisation & general exercise

Mohammadimajd, E., Lotfinia, I., Salahzadeh, Z., Aghazadeh, N., Noras, P., Ghaderi, F., . . . Choopani, R. (2020). Comparison of lumbar segmental stabilization and general exercises on clinical and radiologic criteria in grade-I spondylolisthesis patients: A double-blind randomized controlled trial. Physiotherapy Research International, e1843. https://be-research-papers.s3.amazonaws.com/Diploma+lecture+research+papers/Lecture+17+Sciatica+pt+2/Mohammadimajd-2020-Comparison+of+lumbar+segmen.pdf

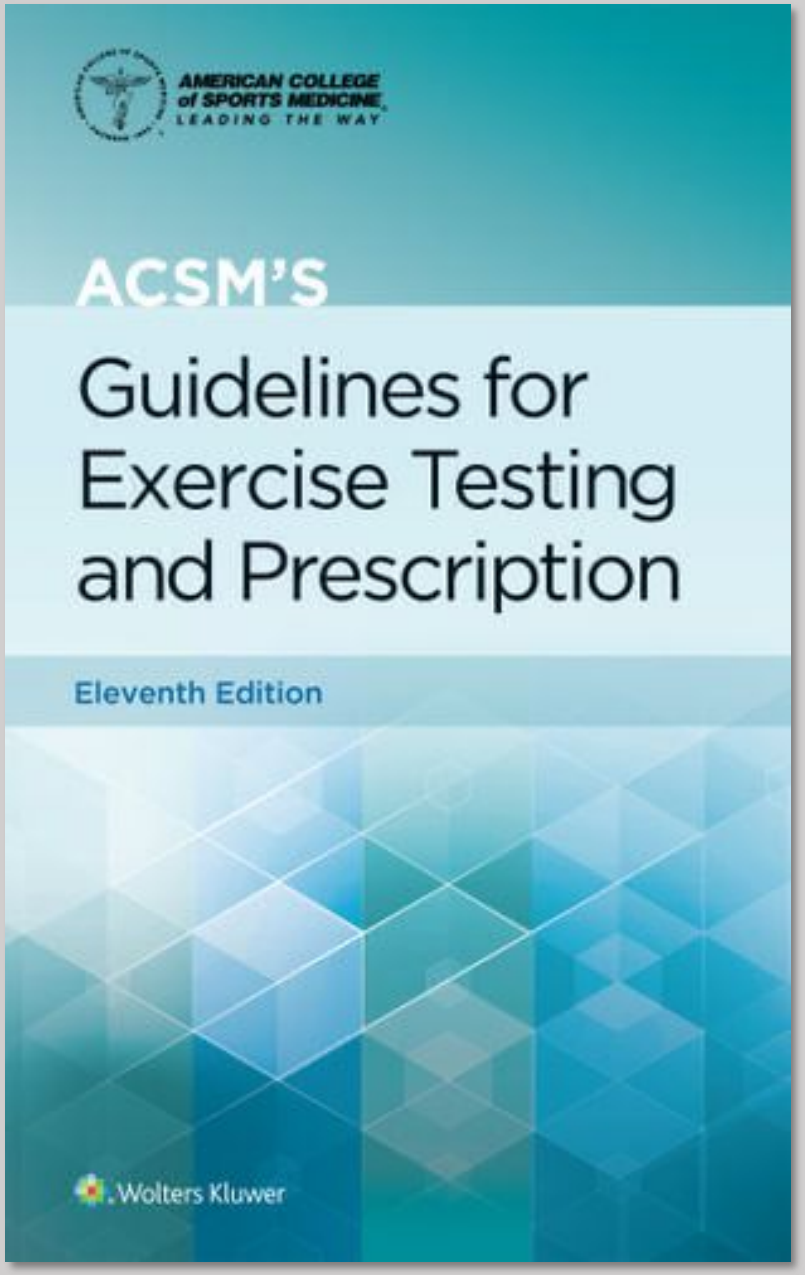
In fact no form of exercise has been shown to be superior

McNeely, M. L., Torrance, G., & Magee, D. (2003). A systematic review of physiotherapy for spondylolysis and spondylolisthesis. Manual Therapy, 8(2), 80-91. https://be-research-papers.s3.amazonaws.com/Diploma+lecture+research+papers/Lecture+17+Sciatica+pt+2/McNeely-2003-A+systematic+review+of+physiother.pdf

Self-test

- What happens to sciatica if we do nothing?
- How does surgery compare to exercise?
- Is stabilization exercise or general exercise more effective for spondylolisthesis?
- True/False: One form of exercise has been shown to be superior for spondylolisthesis

Guideline-care is
reassurance &
advice to stay active



ACSM's Guidelines

Liguori, G., & American College of Sports Medicine. (2020). ACSM's guidelines for exercise testing and prescription: Lippincott Williams & Wilkins.

Current literature does not support a definitive cause for initial bouts of LBP (42). However, previous LBP is one of the strongest predictors for future back pain episodes (36); therefore, once an individual suffers an initial episode of LBP, they are in fact more susceptible to future episodes of LBP. Recurrent episodes of LBP tend toward increased severity and duration, higher levels of disability, including work disability, and higher medical and indemnity costs (53,54). Current guidelines place a heavy emphasis on preventive measures and early interventions to minimize the risk of an acute LBP episode from becoming chronic and/or disabling (55). Additionally, best evidence for treating LBP indicates PA as a key component in managing the condition (56–59).

Liguori, G., & American College of Sports Medicine. (2020). ACSM's guidelines for exercise testing and prescription: Lippincott Williams & Wilkins.

The best available evidence supports a classification approach that de-emphasizes the importance of identifying specific anatomical lesions after red flag screening is completed (42).

Liguori, G., & American College of Sports Medicine. (2020). ACSM's guidelines for exercise testing and prescription: Lippincott Williams & Wilkins.

Exercise Prescription

Current guidelines for the management of LBP consistently recommend staying physically active and avoiding bed rest (38,42,55,59,86). Although it may be best to avoid exercise in the first few days immediately following an acute and severe episode of LBP so as not to exacerbate symptoms (57,59), individuals with subacute and chronic LBP, as well as recurrent LBP, are encouraged to be physically active (57). Within 2 wk of an acute LBP episode, activities can be carefully introduced. Regular walking is a good way to encourage individuals with LBP to participate in activity that does not worsen symptoms (55). Both progressive aerobic training and progressive resistance training have been shown to be equally effective at decreasing pain intensity in individuals with chronic LBP (87).

When recommendations are provided, they should follow very closely with the recommendations for the general population, combining resistance, aerobic, and flexibility exercise (see *Chapter 5*). In chronic LBP, exercise programs that incorporate individual tailoring, supervision, stretching, and strengthening, coupled with client preference and practitioner expertise, are associated with the best outcomes (57,59,88). Furthermore, the evidence supporting the multidimensional nature of nonspecific chronic LBP shows most favorable outcomes with an individualized approach that addresses psychological distress, fear avoidance beliefs, self-efficacy in controlling pain, and coping strategies (78). Whereas Ex R_x can play an integral role in helping a client manage LBP, the diagnosis and treatment of LBP falls outside the scope of practice of most exercise professionals and needs to be referred to a licensed health care provider (89).

Special Considerations

- Exercises that address coordination, endurance, and strengthening of the trunk can be used to reduce LBP and disability in individuals with subacute and chronic LBP with movement coordination impairments (44). However, there is insufficient evidence for any benefit of emphasizing single-dimension therapies such as abdominal strengthening (78,85,90).
- Individual response to back pain symptoms can be improved by providing assurance, encouraging activity, and providing early referral to physical therapy (46,47,85).
- There is a lack of agreement on the definition, components, and assessment techniques related to core stability. Furthermore, the majority of tests used to assess core stability have not demonstrated validity (91,92).

- Certain exercises or positions may aggravate symptoms of LBP. Walking, especially downhill, may aggravate symptoms in older adults with LBP (93). However, walking on an inclined treadmill or cycling with the lumbar spine flexed may be helpful for individuals that find more upright positions bothersome.
- Certain individuals with LBP may experience a "peripheralization" of symptoms, that is, a spread of pain into the lower limbs with certain sustained or repeated movements of the lumbar spine (94). Limits should be placed on any activity or exercise that causes spread of symptoms (58).
- Repeated movements and exercises such as prone press-ups or knees to chest in supine that promote centralization (*i.e.*, a reduction of pain in the lower limb from distal to proximal) are encouraged to reduce symptoms in patients with acute LBP with related lower extremity pain (42).

- Flexibility exercises are generally encouraged as part of an overall exercise program. Hip and lower limb flexibility should be promoted (56,84). However, in individuals with LBP and movement coordination impairments, strengthening and/or motor control exercises should be emphasized, not flexibility (42).
- Consider progressive, low intensity aerobic exercise for individuals with chronic LBP with generalized pain (pain in more than one body area) and moderate-to-high intensity aerobic exercise for individuals with chronic LBP without generalized pain (42).
- Exercises such as yoga and Pilates have shown to be effective interventions for LBP, however, the research is not clear on whether any single intervention is superior to another; therefore, the choice of exercise should fundamentally be driven by client preference and practitioner expertise (95,96).

Guideline-care for people with spondylolisthesis, LBP & sciatica

- Reassurance
- Advice to stay active

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Self-test

- True/False: Current evidence supports a definitive cause for low back pain
- True/False: Guidelines recommend de-emphasizing the importance of identifying specific anatomical lesions after red flag screening is completed
- What DO guidelines recommend?

Learning goals

1. Spondylolisthesis is not a specific cause of back pain
2. Sciatica is complex and multifactorial, and often related to whole-person factors
3. Surgery & all forms of exercise seem to work equally well
4. Guideline-care is reassurance and advice to stay active

Questions?

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