Revisiting the “Red Flags” in Acute Low Back Pain

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Review

PEER REVIEWED

Volume 65 - Issue 1 - January 2025

Abstract. When evaluating patients presenting with low back pain, conducting a targeted history and physical examination is vital to identify indications of a potentially significant underlying condition, what we call, “red flags.” This was true more than a decade ago, when I (DDG) first published “Acute Low Back Pain: Recognizing the ‘Red Flags’ in the Workup” in the June 2013 issue of *Consultant*,[1] and it is still true today.

While revisiting the "red flags” article, it became clear that the approach to recognizing red flags has not significantly changed since 2013. Red flags still signal a more serious issue, particularly for those with:

- pain persisting beyond 6 weeks,
- pain in individuals younger than 18 years of age or older 50 years of age,
- those with a history of major trauma, systemic symptoms, or atypical features such as nocturnal or unrelenting pain, and
- those with a history of cancer or immunocompromised states, including diabetes.

Additionally, the appearance of acute or progressive neurological deficits, incontinence, a reduction in rectal tone, and saddle anesthesia are crucial signs. Recognizing these indicators can lead to more informed choices regarding further laboratory tests and diagnostic imaging, improving cost and efficiency.

Introduction. In 2020, low back pain (LBP) affected 619 million individuals worldwide, making it a leading cause of disability. Projections indicate a rise to 843 million cases by 2050, mainly due to demographic growth and an aging population.[2] In the United States, within a 3-month period, 39% of adults reported experiencing back pain, with prevalence increasing alongside age—starting from 28% for those 18 to 29 years of age to 45% for those 65 years of age and older. Notably, LBP was more frequently reported by women than men.[3]

Generally, LBP is divided into four categories: serious, specific, non-specific, and pain not being related to the lumbar spine. Serious etiologies include epidural abscess, vertebral osteomyelitis, spinal metastases, and epidural compression syndrome. Specific LBP has an identifiable cause, such as a distinct spinal condition or disease. Conversely, non-specific LBP lacks a pinpointable etiology and accounts for approximately 90% of cases.[4] This type is also called idiopathic LBP, highlighting its unknown origin. The final cause, pain not related to the lumbar spine, refers to LBP from another part of the body and not due to spinal disease.

For most individuals with acute LBP, approximately 85% to 90%, a definitive cause is never determined.[5,6] Although symptoms generally resolve within 4 to 6 weeks, all patients with back pain should be thoroughly evaluated to rule out significant neurologic or life-threatening disease processes. The phrase "red flags" of back pain describes important historical and physical features that may be associated with potentially dangerous conditions. The presence of a red flag warrants close attention and potentially diagnostic testing. Established by the Agency for Health Care Policy and Research in 1994, these guidelines have been relatively consistent as a guide and have minimally changed since.[5] This is likely because many of the red flags investigated were from single studies and few studies investigated the same index tests. There was also little uniform agreement on the definition of the red flags that were studied.[7]

In this article, we discuss the approach to the patient with LBP, paying particular attention to these red flags. A prior study found that only 5% of primary care physicians regularly screen for the presence of red flags in patients with LBP.[8] Further, it was found that physicians will only regularly inquire about two out of the seven red flags, and that patient-entered data that does not rely on physician involvement may represent a more consistent and reliable alternative to screen for the presence of red flags.[8] Although, the patient-reported red flags had low sensitivity and specificity for identification of serious pathologies.[8]

In addition to our discussion of the use of the red flags, we also review standard diagnostic methods employed in such evaluations. But let’s begin by focusing on the patient history.

A focused patient history. A focused history is the most critical tool for identifying risk factors for serious disease in a patient with LBP. Directing the history with consideration of the red flags allows for an efficient, cost-effective assessment (Table 1).

Table 1. Clues in the history that raise a “red flag” in the evaluation of low back pain

Red flags	Possible cause
Duration > 6 weeks	Tumor, infection, rheumatologic[6,9]
Age < 18 y	Congenital defect, tumor, infection, spondylolysis, spondylolisthesis[11]
Age > 50 y	Tumor, intra-abdominal processes (such as an abdominal aortic aneurysm), infection[6,12,13]
Major trauma, or minor trauma in elderly	Fracture[6,7]

Cancer	Tumor[6,23,24]
Fever, chills, night sweats	Tumor, infection[6,12]
Weight loss	Tumor, infection[6,12]
Injection drug use	Infection[6,20,28]
Immunocompromised status	Infection[6,20,28]
Recent genitourinary or gastrointestinal procedure	Infection[6,20,28]
Night pain	Tumor, infection[6,24]
Unremitting pain, even when supine	Tumor, infection, abdominal aortic aneurysm, nephrolithiasis[6,28]
Pain worsened by coughing, sitting, or Valsalva maneuver	Herniated disk[14,28]
Pain radiating below knee	Herniated disk or nerve root compression below the L3 nerve root[14,28]
Incontinence	Cauda equina syndrome, spinal cord compression[6,24,28]
Saddle anesthesia	Cauda equina syndrome, spinal cord compression[6,24,28]
Severe or rapidly progressive neurologic deficit	Cauda equina syndrome, spinal cord compression[6,24,28]

Within a patient history, clinicians should investigate and consider a patient's duration of symptoms, age, location and radiation of the pain, trauma history, any systemic complaints, atypical pain features, associated neurologic deficits, cancer history (if any), urinary, abdominal, or chest complaints, whether the patient is immunocompromised, has a history of injection drug use (IDU), or a history of anticoagulant use.

Duration of symptoms. Generally, LBP falls into three categories based on duration:

- Acute pain lasts less than 6 weeks
- Subacute pain continues for 6 to 12 weeks
- Chronic pain persists for more than 12 weeks

Pain lasting longer than 6 weeks is concerning, as 80% to 90% of all episodes of LBP resolve within 6 weeks.[9] If the patient has been previously assessed for LBP, and pain persists for more than 6 weeks, further evaluation is warranted. However, if the patient has had pain for a shorter period without appropriate treatment, it is reasonable to delay the workup and observe them closely, provided there are no other red flags.[6] At that initial presentation, prescribe analgesia, activity modification measures and physiotherapy.[10] If there is a lack of dramatic improvement after 4 weeks, then it is reasonable to begin the diagnostic workup.[6] For a patient with chronic symptoms who has already undergone a complete evaluation, the previously performed workup should be reviewed to ensure thoroughness and that vital clues or signs of alternative diagnoses have not been missed.

Age. Back pain in patients younger than 18 years of age or older than 50 years of age is considered a red flag. In both groups, LBP is more likely to be due to serious causes.

- Patients younger than 18 years of age have a higher incidence of congenital and bony abnormalities, such as spondylolisthesis or spondylolysis (the most common pathologic diagnosis), in addition to an increased likelihood of pathologic etiology as compared to their adult counterparts.[11]
- In patients older than 50 years of age, cancer has a higher likelihood.[6] Additionally, diagnoses not related to the spine, such as a rupturing abdominal aortic aneurysm or other acute intra-abdominal processes, should be considered.[12,13]
- Spinal stenosis resulting from hypertrophic degenerative processes and degenerative spondylolisthesis is more common in those older than 65 years of age.[6]
- In patients older than 74 years of age, there is an increased likelihood of vertebral fracture, especially when combined with female sex, trauma, and/or corticosteroid use.[7]

Location and radiation of the pain. Pain originating from muscular or ligamentous strain or disc disease without nerve root involvement is located primarily in the back, possibly associated with radiation into the buttocks or thighs. Pain with radiation below the knee is concerning for a herniated disc or nerve root compression inferior to the L3 nerve root, based on the dermatomal distribution. This pain radiates along the entire nerve pathway.[14] Most herniated discs occur at the L4-5 or the L5-S1 disc space, thereby impinging on the L5 or S1 nerve root and producing radiculopathy that extends into the lower leg and foot along the pathway of the involved nerve root.[14-16] Disc herniation occurs less frequently at the L3-L4 disc level with associated L4 nerve root impingement.[16]

The location of the pain helps distinguish LBP from sciatica, which is radicular pain that radiates into the legs in the distribution of a lumbar or sacral nerve root and is often accompanied by sensory and motor deficits. Sciatica may be associated with LBP, but patients with sciatica primarily express discomfort regarding radicular leg symptoms more so than the back pain.[14] Although the lifetime prevalence of sciatica is between 15% to 40%, only 5% to 10% of patients with LBP have sciatica.[18]

Determination of dermatomal distribution is helpful when evaluating radicular pain. If unilateral and isolated to a single nerve root, this is more consistent with a herniated disc. If involving multiple nerve roots or bilateral, this is concerning for more serious spinal compressive pathology. 5 Bilateral symptoms may also be due to lumbar spinal stenosis, especially if worse with walking and improved with leaning forward and sitting.[6,19]

History of trauma. Trauma is a red flag that could indicate a fracture and should prompt the ordering of computed tomography (CT) imaging of the relevant spinal area. In older adults, even a minor fall from a standing or seated position can be concerning due to age-related bone density loss, such as osteoporosis.[7]

Systemic complaints. Constitutional symptoms such as fever, chills, night sweats, malaise, or unintended weight loss may suggest infection or malignancy. These symptoms warrant further review, particularly if the patient has additional risk factors for infection, such as diabetes, recent bacterial infection, immunocompromised status, steroid use, or IDU. In patients who inject drugs, back pain should be initially considered as possibly resulting from vertebral osteomyelitis, discitis, or spinal epidural abscess, with the diagnosis to be confirmed or ruled out by advanced imaging. Additionally, a recent genitourinary or gastrointestinal procedure may predispose the patient to infection secondary to hematogenous spread.[20]

Atypical pain features. These are descriptions of the pain that are less commonly seen in idiopathic or benign low back pain. Uncommon characteristics of pain can help differentiate more serious causes from benign or idiopathic LBP. Generally, benign LBP presents as a persistently aching discomfort that tends to worsen with activity but improves with rest or lying down. Red flags for cancer and infection include night pain that wakes the patient from sleep and is unrelenting despite adequate rest and analgesic use. Herniated disc pain may be aggravated by activities such as coughing, sitting, or performing the Valsalva maneuver and often improves when lying flat.[14,16,17] Spinal stenosis generally results in bilateral sciatic pain that is exacerbated by standing for long periods or walking, and relieved with rest or forward bending. Our experience suggests that night or unrelenting pain despite appropriate analgesic use can be a critical, yet frequently overlooked warning sign in evaluating back pain, though night pain alone lacks specificity and sensitivity for serious pathology.[21]

Associated neurologic deficits. Most patients with benign LBP do not exhibit significant neurologic symptoms. However, the presence of severe or rapidly progressing neurologic deficits, especially in conjunction with bowel or bladder dysfunction, should raise concerns for conditions like cauda equina syndrome, spinal epidural hematoma, conus medullaris syndrome, or epidural compression syndrome. This is concerning in the patient who reports a new bowel or bladder incontinence.

For patients reporting urinary incontinence, even a single episode warrants measuring a post-void residual (PVR) bladder volume. A PVR over 200 mL is abnormal and suggests overflow incontinence, necessitating further evaluation.[22] In the context of back pain, this indicates possible serious neurologic compromise and should prompt urgent investigation for an epidural compression syndrome. A PVR less than 200 mL reduces the likelihood of severe neurologic involvement but does not rule it out in the presence of other concerning neurologic signs.[22] Additional symptoms, like paresthesia, weakness, numbness, or gait abnormalities, require thorough assessment to ascertain the involvement of one or multiple nerve roots.

History of cancer. Patients with a known history of certain cancers—such as those of the breast, lung, thyroid, kidney, prostate, multiple myeloma, lymphoma, or sarcoma—are at elevated risk for metastatic spinal disease.[23,24] Back pain is the presenting symptom in more than 90% of these cases.[23]

Urinary, abdominal, or chest complaints. Although no specific red flags are associated with these areas, a thorough review is necessary to avoid missing conditions that may present as referred or radiating back pain. The most critical of these is a ruptured abdominal aortic aneurysm. Other possible causes of referred pain include pancreatitis, lower lobe pneumonia affecting the posterior lung fields, nephrolithiasis, pyelonephritis, retroperitoneal hemorrhage, and renal infarction.[12,13] Additionally, pain originating from a thoracic spine compressive lesion can sometimes be perceived in the abdomen, leading to a misdirected abdominal-focused evaluation. This is due to the upper abdominal musculature receiving somatosensory innervation from nerve roots at levels T7 to T12.[25]

Immunocompromise and IDU. Thought to be due to the increasing prevalence of intravenous drug use, diabetes, and/or use of immunosuppressive medications, there has been a significant increase in hospital admissions for spinal epidural abscesses and other spinal infections.[13,20] Query patients regarding corticosteroid use, IDU, HIV, alcoholism, and immunosuppressive agents for autoimmune conditions or cancer diagnosis. Those using corticosteroids are also at higher risk for vertebral fractures.[7]

Anticoagulant use. While typically related to anticoagulant use, trauma, or recent spinal procedural, spinal epidural hematoma (SEH) is an important, must not miss, diagnosis. Additionally, retroperitoneal hemorrhage related to anticoagulant use can also mimic severe low back pain.[13,21] Patients with SEH typically present with severe back pain that persists

despite adequate analgesia and can progress to a loss of sensory and motor function due to spinal cord or cauda equina compression.[26] Differentiating this diagnosis from other pathologic etiologies of LBP is challenging. Inquiring about the use of anticoagulant or antiplatelet agents, as well as recent neuraxial procedures (lumbar puncture, spinal anesthesia), can aid in the diagnosis. However, in a meta-analysis of spinal epidural hematoma cases, approximately one-third of patients had no identifiable causative factor.[13,26]

Physical examination. The examination is neither complicated nor prolonged and is directed toward ruling out red flags and identifying specific neurologic deficits (Table 2).

Table 2. "Red flags" in the physical examination of patients with low back pain

Red flags	Possible cause
Fever	Infection
Unexpected anal sphincter laxity	Cauda equina syndrome, spinal cord compression[6,24,28]
Perianal/perineal sensory loss	Cauda equina syndrome, spinal cord compression[6,24,28]
Major motor weakness	Nerve root compression[12,24,28]
Point tenderness to percussion	Fracture or infection[28]

Attention should be paid to initial appearance and vital signs. Fever strongly suggests infection.[8,13,27] Unfortunately, this sign is not very sensitive, ranging from 27% for tuberculous osteomyelitis, 50% for pyogenic osteomyelitis, and 83% for spinal epidural abscess.[28]

General appearance. Patients are best assessed when in a gown. The patient with benign LBP is most comfortable when lying still. Consider abdominal aortic aneurysm, retroperitoneal hemorrhage, ureterolithiasis, pancreatitis, or acute infection in those who are in extreme pain or writhing in pain.

Abdomen. An abdominal examination is essential for all patients, including auscultation for bruits and palpation for masses, tenderness, or suprapubic fullness. Patients with benign LBP do not typically exhibit abdominal tenderness.

Back. A comprehensive musculoskeletal examination should be performed next. This includes inspection of the skin for signs of underlying pathology, such as erythema, warmth, and purulent drainage indicative of infection, or contusion and swelling suggestive of trauma. A vesicular dermatomal eruption may indicate herpes zoster. During palpation, tenderness over the vertebral bodies can point to possible fractures or bacterial infections, noted with a sensitivity of 86% and specificity of 60% for infections. [28]

The straight leg raise test is an integral part of diagnosing lumbar disc herniation: [6,14]

- With the patient lying supine, lift each leg in turn to approximately 70° to reproduce the pain.
- A positive result consists of reproducing the patient's radicular pain down the affected leg belowthe knee. The radicular pain is worsened by ankle dorsiflexion and improved with ankle plantar flexion or decreased elevation.
- Reproduction of the patient’s back pain or pain in the hamstring area, not below the knee, does not constitute a positive result.
- While a positive straight leg raise is highly sensitive for diagnosing a L4-5 or L5-S1 herniated disc, it is not highly specific. Conversely, radicular pain in the affected leg, when lifting the asymptomatic leg (positive crossed straight leg raise), is highly specific (but not sensitive) for nerve root compression by a herniated disc.[14,17]

Neurologic examination. This critical component is fundamental to the entire examination. It enables clinicians to identify urgent surgical emergencies and to delineate anatomic deficits, such as those associated with a herniated disc. This comprehensive evaluation includes gait assessment, sensation, strength, and deep tendon reflexes of the lower extremities. A digital rectal examination and measurement of post-void residual bladder volume are performed as indicated. A detailed baseline neurologic examination is crucial for tracking the onset and progression of symptoms and should be documented with precision, beyond simply noting findings as “within normal limits.”[12]

Test sensation by using light touch initially, followed by a pinprick, temperature, proprioception, and vibration if there are abnormalities on the initial light touch exam. Sensory findings such as paresthesia and hypoesthesia are infrequent and can be concerning for nerve root compression.[29] When a sensory deficit is detected, it is essential to characterize its dermatomal distribution.[29]

The examination as it pertains to each of the spinal nerve roots in the lumbosacral plexus can be described in several ways.[12,28] The 2013 *Consultant* article[1] described it this way: (which remains accurate as of this writing):

- The L1 through L3 nerve roots supply sensation over the anterior thigh and provide strength to the hip flexors. There is no well-defined reflex for these nerve roots.

- The L4 nerve root is responsible for sensation over the medial surface of the leg and foot, including the medial surface of the great toe, but not the first dorsal web space. The motor component of L4 involves leg extension (L2 through L4) and ankle dorsiflexion and inversion. The patellar reflex is innervated predominantly by the L4 nerve root, although there is some contribution from L2 and L3.
- The L5 nerve root supplies sensation over the lateral leg and the dorsum of the foot, including the first dorsal web space. The muscular innervation for L5 is the extensor hallucis longus (great toe dorsiflexion) and dorsiflexors of the foot. There is no well-defined reflex for L5.
- The S1 dermatome covers the plantar and lateral surfaces of the foot. It innervates the peroneal muscles, which evert the foot and, along with the S2 nerve root, is responsible for the muscles that plantar flex the foot and allow toe walking. The S1 nerve root innervates the Achilles reflex.
- The S2 through S4 nerve roots supply sensation to the perineum, making the three concentric rings surrounding the rectum. They are responsible for innervating the bladder and intrinsic muscle of the foot. These nerves innervate the anal wink reflex that is obtained by gently stroking the skin on the outside of the anus, causing a reflex contraction of the external anal sphincter.[1]

An upper motor neuron pattern may be found on the exam if compression occurs above the conus medullaris with evidence of hyperreflexia below the level of compression, positive Babinski reflex, and increased muscle tone. Decreased reflexes or areflexia indicate lower motor neuron lesions and are present in nerve root compression.[12,28] Perform a digital rectal examination to evaluate for rectal tone and perineal sensation. A rectal exam is not indicated for all patients with low back pain. Instead, it is indicated in those patients with red flags, especially those with neurologic complaints or severe pain. The absence of the superficial reflex or perineal sensation indicates dysfunction of the S2 through S4 nerve roots as previously described. Poor rectal tone in association with back pain and saddle anesthesia is indicative of epidural spinal cord compression or cauda equina syndrome.[27,28]

Diagnostic tests. Understanding whether a patient needs further laboratory tests and diagnostic imaging can improve costs and efficiency.

Laboratory tests. Order a complete blood cell count (CBC), erythrocyte sedimentation rate (ESR), C-reactive protein (CRP), urinalysis (UA), and blood cultures if there is suspicion of infection. Coagulation studies, to include activated thromboplastin time (PTT), prothrombin time (PT), and International normalized ratio (INR) should be obtained on those where SEH is considered.[30] The white blood cell count may be normal or elevated in patients with infection; the ESR is almost always elevated in patients with osteomyelitis and epidural abscess.31-33 An ESR greater than 20 mm approaches a sensitivity of 100% for spinal epidural abscess but has poor specificity. [13] CRP levels are also likely be elevated in patients with acute spinal infection.33,34 In immunocompromised patients, caution should be used as

the white blood cell count or inflammatory markers may not be elevated, and their use has not been well studied. Do not order inflammatory markers in patients without red flags or if the primary diagnostic considerations are disk herniation or epidural hematoma. [13]

Test results are generally within normal limits in patients with neoplastic disease involving the spine; however, the ESR may be elevated.[6,35] Order a urinalysis to evaluate for a genitourinary source of infection that may have seeded the spine or primary renal disease referred to the back. 19 If the laboratory results are unrevealing but there is high suspicion for infection or tumor, the next step is to proceed with spinal imaging.[13,36]

Imaging studies. As supported by The American College of Radiology (ACR) appropriateness criteria and the American College of Emergency Physicians (ACEP), spine imaging is not recommended in patients with acute back pain in the absence of severe or progressive neurological deficits or a suspected serious underlying disease.[37,38]

Radiographs. Clinicians should obtain plain radiographs only if there is a suspicion of an atraumatic vertebral fracture.7,38 Only anteroposterior and lateral films of the lumbar spine are necessary.[38] This imaging modality may, however, be limited in those with history of osteoporosis, warranting further investigation with CT imaging. Historically, the imaging approach for suspected tumors and infection involved an initial set of plain radiographs, progressing to more advanced imaging such as MRI if the radiographs were normal yet clinical suspicion remained high. However, with advancements in imaging technology and evidence-based practices emphasizing patient safety and the need for efficient diagnosis, MRI is favored for its superior sensitivity and specificity, particularly in early detection of pathology where timely intervention is crucial.[38] Therefore, when plain radiographs are non-diagnostic and clinical suspicion persists, it is prudent to proceed directly to MRI for a definitive diagnosis.[13,38]

MRI: the preferred approach. Generally,MRI is considered the imaging method of choice for a comprehensive assessment of LBP due to its superior ability to delineate details of the soft tissues, spinal canal, and spinal cord. It excels in detecting disc pathology.[38] MRI is crucial for emergent evaluation of cauda equina syndrome, epidural compression syndrome, spinal infection, malignancy and other spinal cord pathology.[38,39] For a thorough investigation of possible spinal epidural abscesses or widespread diseases such as cancer, the entire spine should be imaged as these conditions often affect multiple sites.[12,13, 25] MRI with and without intravenous contrast is recommended to enhance the visibility of suspected infections or tumors.38 In situations where cauda equina syndrome is the primary concern, focusing the imaging on the lumbar spine may be sufficient. However, in patients exhibiting symptoms indicative of upper motor neuron involvement, a more extensive examination is warranted, as thoracic or cervical spinal compression might be present and could go undetected if only the lumbar region is assessed.13,25The limitations of MRI include its availability, the time needed to perform the scan, and the requirement for patients to remain still in a prone position for the duration of the imaging process.[12] In cases where an MRI

yields negative results, yet clinical suspicion remains high, it is advised that the clinician revisits the patient's case, discusses findings with the radiologist for closer review, and considers additional diagnostic procedures such as a lumbar puncture or a neurology referral for conditions like transverse myelitis, viral lumbosacral radiculitis, or Guillain-Barré syndrome.[13,40]

CT imaging. CT excels compared with MRI regarding detailed visualization of the spine's bony structures. This imaging modality is particularly adept at identifying issues with vertebral fractures, facet joints, and the spine's posterior elements. CT without contrast is the recommended imaging modality if concerned for traumatic vertebral fracture. The general availability of CT scans renders them a practical choice in urgent situations or when an MRI is inaccessible. For cases where spinal canal involvement is suspected but MRI is not an option, CT myelography is an excellent substitute, providing a clear image of the spinal canal.[38] Additionally, CT myelography can be utilized when patients have MRI incompatible devices, hardware, or weight limitations.[38] However, it is important to recognize that MRI is the preferred method for detecting epidural compression or spinal infection. Relying on a standard CT scan without myelography for these conditions might overlook critical internal spinal canal lesions, potentially giving a false sense of security regarding the absence of such lesions.[38]

Conclusion. In conclusion, LBP represents a significant clinical challenge that demands a nuanced approach, given its prevalence and the potential impact on quality of life and healthcare systems. While most acute LBP cases are self-limiting, a systematic assessment process that includes a careful consideration of “red flags” is essential for identifying serious underlying pathologies. Health care practitioners must remain adept in employing evidence-based diagnostic strategies and in providing patient-centered care. This includes judicious use of diagnostic testing and appropriate follow-up, thereby ensuring both the effective management of benign cases and the timely intervention in more serious conditions.

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DISCLOSURES:
The views expressed are those of the author and do not reflect the official policy or position of Madigan Army Medical Center, the US Army, Department of Defense or the US Government

CITATION:
Della-Giustina D, Osborne K. Revisiting the “Red Flags” in Acute Low Back Pain. *Consultant*. Published online: November 27, 2024 doi:10.25270/con.2024.11.000006

Received March 6, 2024. Accepted July 22, 2024.

ACKNOWLEDGEMENTS:
None.

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