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Evaluation and Management of Back Pain in the Elderly

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Abstract Back pain is common in the elderly. Most back pain is uncomplicated but identifying back pain due to serious systemic disease is essential. History and physical exam are critical to this distinction and guide further diagnostic evaluation. There are numerous treatments available for acute and chronic back pain, yet there are special considerations when treating the elderly. Treatment is comprehensive with pharmacotherapy, physical therapy, and alternative methods. Pharmacologic therapy for back pain is targeted at reducing inflammation and providing analgesia. Physical therapy is a necessary part of any treatment plan. Non-pharmacologic treatments are broad in scope and consist of activity-based modalities and alternative therapies. Acute back pain generally has a good prognosis, while chronic back pain can be associated with significant morbidity. This update will review the epidemiology, pathophysiology, evaluation, and treatment of back pain with a particular emphasis on issues unique to the geriatric population.

Keywords Back pain · Elderly · NSAIDs · Muscle relaxant · Degenerative spine disease · Spinal stenosis · Herniated disc

Introduction

Back pain is an ancient condition; the earliest recorded medical documents show that humans had back pain and sought medical attention for this ailment, and spine disease was recorded, as early as seventeenth century BC in the Edwin Smith Surgical Papyrus [1]. Degenerative changes of the spine were found in early human remains, such as the Neanderthals and ancient Egyptian mummies, and from Medieval and Victorian England. Back pain in association with many diseases including spinal deformities and fractures was recorded at the time of Hippocrates. He used the term "sciatic" to describe pain originating from or around the hip or thigh ("ischiatic") and noted that men aged 40–60 years were most affected. Hippocrates recorded recovery in the young usually occurred within 40 days, the first such natural history study. Surgical treatment with laminectomy was described in 600 AD. Back pain was also described as a temporary condition affecting joints and muscles, treated with topical agents and spas, suggesting that uncomplicated back pain was also recognized in ancient times.

In the 1700s, rheumatism was the term for general joint and muscle pain, and back pain was included in this category. At the time, back pain was thought to be due to evil humors flowing from the brain to the joints, precipitated by exposure to damp and cold. In the early 1800s, attention turned to the hypothesis that inflammation (without fever) was the cause for rheumatism. The idea that back pain could originate from the spine and could be caused by trauma was a novel idea sparked by industrialization and injuries incurred during building of the railways.

Several reports during the early 1900s identified a link between prolapse of the intervertebral disc and sciatica. The neurological basis for sciatica was described by Leszynsky as pain restricted to the course of the sciatic nerve. He also detailed the potential associated neurological deficits (weakness, sensory loss in dermatomal distribution), the various etiologies (neuritis, radiculitis, neuralgia), and treatment (bed rest, counterirritants, heat, and injections of saline or saline with novocaine). In the 1930s, the combined efforts of a neurosurgeon and orthopedic surgeon led to the identification of disc rupture and protrusion as a cause of sciatica [2•].

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Much has since been discovered regarding the pathophysiology of acute and chronic back pain. Myriad pharmacologic therapies are now available. However, the geriatric population presents unique treatment challenges. Normal physiological changes in the nerves, muscles, and metabolism, as well as psychosocial factors and comorbid disease all affect the diagnosis and treatment of the elderly with back pain.

Epidemiology

Various data sets underscore the common prevalence of back pain in the elderly. One study estimates that 36 % of the population in the community over the age of 65 years will experience at least one episode of back pain per year [3]. The Jerusalem Longitudinal Study followed 277 patients 70 years of age and found 44 % prevalence of chronic back pain. Prevalence increased to 58 % by age 77 years. At both age 70 and 77 years, factors associated with back pain included: female gender, economic hardship, loneliness, fatigue, poor self-rated health, dependency in activities of daily living (ADLs), joint pain, and obesity. At age 70 years, depression was associated with back pain, while at 77 years of age, hypertension, osteoporosis, and poor sleep were associated [4]. Several other population studies identified similar and additional risk factors: female gender, smoking, older age, strenuous work, sedentary work, and mood disorders (anxiety, depression).

Back pain reduces quality of life and is correlated with additional problems related to mobility, independence, sleep quality, and falls. In a prospective study assessing patients over 70 years, restricting back pain was independently associated with reduced activity [5]. Back pain correlated with increased use of health care resources and mortality in persons over 60 years [6]. Forty percent of those >64 years with severe chronic pain (arm, leg, or back pain) reported sleep trouble [7]. In Japanese studies, lower back pain was associated with falls in women [8], and back pain affected physical quality of life more than knee pain in elderly men [9]. In addition to risk of actual falls, fear of falling due to back pain or other causes can limit functional activity in the elderly. One study evaluated the fear of falling in elderly women with osteoporosis, and those with more pain were more likely to have a higher fear of falling and less functional activity [10]. The fear-avoidance beliefs model (FABM) in the elderly with chronic lower back pain showed that age, pain intensity, and fear-avoidance beliefs predicted functional capacity but not actual physical activity [11]. A large cross-sectional study of men and women utilizing both surveys and physical examination tasks found no significant association between pain intensity and physical performance (in the lower extremities); however, there was a significant association between self-reported functional difficulty and pain intensity [3]. These studies suggest that perhaps factors other than pain itself may contribute to functional decline in the elderly with back pain, which may be more amenable to novel interventions.

Depression is of concern in the elderly and can be precipitated or exacerbated by many factors, including back pain [12]. Importantly, depression in elderly patients with lower back pain could contribute to worse quality of life. A large cross-sectional cohort study of the elderly over age 65 years were evaluated by survey at baseline and 2-year follow-up. At baseline, depressive symptoms were found in 20 % of the cohort. The presence of depressive symptoms at baseline was independently associated with disabling lower back pain at the 2-year follow-up. Likewise, disabling lower back pain at baseline was independently associated with depression at 2-year follow-up [13].

Morbidity and mortality may also be increased in elderly patients with back pain. An Australian study found frequent back pain correlated with a hazards ratio >2.0 for greater mortality, coronary heart disease, lower quality of life, and reduced mobility [14]. In all age groups, obesity is associated with increased morbidity. A population-based survey from the NHANES group analyzed adults aged 60 years or more for back, knee, and hip pain and correlated this with body mass index (BMI). Prevalence of each type of pain increased with BMI from 20 % in the underweight to 26 % in the obesity class III group for back pain [15].

Correlation of radiographic evidence of degenerative changes of the spine with back pain is a subject of ongoing debate, highlighting the importance of judicious use of imaging studies. One large epidemiological study investigated the prevalence of radiographic lumbar spondylotic disease in elderly patients with lower back pain. A high overall prevalence of radiographic spondylosis was found, and both age and BMI were correlated with more severe radiographic spondylosis. Overall, there was no clear association of back pain and presence or degree of spondylosis, except for in women with the most severe radiographic spondylosis [16].

Spondylolisthesis, vertebral forward slip of 5 % or more on radiograph, may be related to back pain, neurogenic symptoms, and functional limitations. One study evaluated this association in men age 65 years or older with lumbar radiographs and self-reported symptoms. While 31 % of all subjects had evidence for radiographic spondylolisthesis, prevalence of back pain was similar to those without radiographic changes. However, neurogenic symptoms (paresthesias, radiculopathy) and functional limitations were more prevalent in the elderly men with spondylolisthesis [17].

There is an ongoing study protocol (BOLD = Back Pain Outcomes using Longitudinal Data) to create a database resource for patient-reported outcome measures and electronic medical record data for the elderly with back pain. The goal is to create a detailed registry facilitating studies and evidence-based care for back pain in the elderly [18•].

Pathophysiology

Back pain is most often uncomplicated and nonspecific in nature. Less than 2 % of all back pain evaluated in the primary care setting is due to serious systemic pathology. Table 1 outlines the various causes for back pain.

Degenerative disease of the spine is widely accepted as common or nearly universal in the elderly. The relationship of the pathophysiology of intervertebral disc degeneration and lower back pain is incompletely understood. Degenerative changes in the disc and surrounding bony vertebrae are often seen by the third decade of life and are nearly universal by the seventh and eighth decades [19].

Normal discs contain layers of fibrous cartilage (annulus fibrosus) surrounding the inner gelatinous proteoglycan (nucleus pulposus). Together, the discs and vertebrae work as a dynamic system to withstand and transmit forces while protecting the closely intertwined neurovascular structures. The annulus fibrosus is densely packed with sensory nerve fibers and blood vessels, especially in the posterior portion. These sensory fibers send signals via the dorsal root ganglion (DRG) at that segmental level or through the sympathetic chain. Damage to the annulus fibrosus is one possible anatomical correlate to back pain. The discs rely on diffusion for obtaining nutrients and eliminating waste because of limited vascular supply. Water content in the discs is high, accounting for the increased signal intensity on T2-weighted images on magnetic resonance imaging (MRI). The water content of the disc decreases during the daytime and increases after lying supine. This diurnal variation is not apparent in the elderly or degenerated discs, suggesting impaired fluid exchange.

Table 1 Causes of back pain

Mechanical/uncomplicated	Complicated
Muscle strain or ligamentous injury	Systemic disease
Degenerative spine disease	• Inflammatory arthritis (psoriasis, ankylosing spondylitis, Reiter's)
• Spondylosis, spondylolisthesis, spondylolysis	Malignancy
• Facet hypertrophy	• Multiple myeloma
• Disc degeneration	• Lymphoma, leukemia
Lumbar spinal stenosis	• Spinal tumors
Disc herniation	• Retroperitoneal tumors
Radiculopathy	• Metastatic carcinoma
Osteoporosis	Infection
Vertebral fractures	• Discitis
Sciatica	• Osteomyelitis
	• Epidural abscess
	• Spinal abscess
	Neurological compromise
	• Cauda equina syndrome
	• Conus medullaris syndrome
	Visceral
	• Abdominal aortic aneurysm
	• Gastrointestinal disease
	• Renal disease
	• Endometriosis, prostatitis

Tears of the annulus fibrosus, caused by trauma, result in damage to the sensory innervation of this layer resulting in pain. Tissue repair, inflammation, regrowth of sensory nerve fibers and blood vessels, and secretion of pro-nociceptive cytokines exacerbate pain. Herniation of the nucleus pulposus triggers inflammation, cytokine and protease release, and granulation tissue formation. If contained, the small- or medium-sized disc herniation is not necessarily associated with pain, but if material is extruded, it will often cause pain and paresthesias from irritation of the nearby dorsal root ganglion, local endoneurial edema, and inflammation.

Disc degeneration results from genetic and acquired factors. Studies in male twins found similar contributions of genetic and environmental influences on disc degeneration when measuring degenerative findings on MRI and surveys to assess environmental factors [20]. Reduced blood supply to the vertebral endplates results in reduced diffusion capacity of the discs. Trauma to the vertebrae leads to bony changes (Schmorl's nodes, osteophytes). Degeneration of the discs can in turn lead to reactive changes in the nearby bony structures. Disc desiccation leading to reduced height (1–3 mm) overloads joints and narrows foramina, and repeated bony stress triggers osteophyte formation. This in turn leads to further reduced motion, disc height, and canal narrowing generating the compressive symptoms seen in spinal stenosis. No treatments are specific to the degree of degenerative changes, but physical therapy regimens could potentially be tailored to degree and timing of loading and flexion [19]. Sacral insufficiency fractures are another cause of lower back pain. There are no associated neurological deficits and these occur most often in the elderly and persons with osteoporosis [21, 22].

Diagnostic Evaluation

The importance of the history and physical exam cannot be overemphasized in the diagnosis of back pain and identifying an underlying etiology. A majority of back pain will be due to nonspecific cause, also referred to as lumbago or musculoskeletal back pain; other causes include radiculopathy, sciatica, spinal stenosis, cauda equina compression, or back pain due to osseous abnormalities. The major back pain syndromes are described in Table 2.

Back pain can be considered acute if the duration is less than 4 weeks, subacute if 4–12 weeks, and chronic if >12 weeks. Back pain can be constant or intermittent and may be triggered by certain activities. Diffuse or focal aching pain over the lower back is the most common and nonspecific but usually a benign presenting symptom. This is often most consistent with musculoskeletal origin back pain. Symptoms suggestive of neuropathic pain include sharp, electric-shock-

Table 2 Back pain syndromes

Syndrome	Cause	Clinical symptoms	Radiographic findings
Nonspecific back pain (lumbago or musculoskeletal)	Muscle strain Ligamentous injury	Mid-lower back pain, diffuse Normal neurological exam	Nonspecific May have degenerative changes
Radiculopathy	Nerve root compression	Lower back pain radiating down the leg: -L5 to lateral thigh, calf, and dorsal foot -S1 to buttock, posterior thigh, calf, and lateral foot Weakness: -L5 (foot dorsiflexion, inversion, and eversion) -S1 (foot plantarflexion), loss of Achilles tendon reflex Sensory loss in dermatomal distribution according to root affected	Herniated disc (usually lateral, to side affected) Degenerative changes causing narrowing of neural foramina
Sciatica	Irritation or compression of the sciatic nerve, may also refer to S1 radiculopathy	Lower back pain radiating down the posterior leg No associated neurological deficits	Usually nonspecific Degenerative changes Herniated disc
Spinal stenosis	Narrowing of the spinal canal due to degenerative spine disease	Neurogenic claudication (back pain with walking, relieved with flexion of lower back such as sitting) Usually normal neurological exam	Degenerative changes of the spine, narrowing of the spinal canal
Cauda equina	Compression of multiple lumbosacral nerve roots	Lower back pain Urinary and/or bowel incontinence Saddle anesthesia Variable weakness in proximal and distal legs Hypoactive reflexes in the legs	Compression of the lumbosacral nerve roots (severe stenosis, herniated disc, tumor, hematoma)
Osseous pain	Osteoporosis Compression fracture Tumor Infection Inflammation	Focal pain at site of lesion	Vertebral fracture Contrast-enhancement (tumor, infection)

like pain that radiates from the back down one or both of the legs and may indicate a radicular origin to the pain. Radiculopathy is from compression of the nerve root as it exits the spinal canal, and while it can occur at any lumbosacral root level, disc herniation and radiculopathy are most common at L5 and S1 (Table 2). Straight leg raise testing can help identify radiculopathy (with patient supine gently raises the leg; pain between 30° and 60° is >85 % specific for nerve root irritation). Back pain (with accompanying leg pain or cramping) from spinal stenosis is worse with walking and improves with sitting which opens the spinal canal (neurogenic claudication). Concerning features must be elucidated on history; fever, night sweats, and weight loss should prompt infectious and malignancy evaluation, while bladder or bowel incontinence require emergent evaluation with imaging to rule out cord compression or cauda equina syndrome. Physical and neurological exam should look for any atrophy, weakness, absent reflexes, and sensory loss and in what pattern or distribution. Any associated trauma, heavy lifting, occupational or recreational duties causing strain, or falls should be ascertained.

Because a large majority of patients with uncomplicated back pain (i.e., in the absence of fever, weight loss, known cancer or infection, neurological deficits) improve within 90 days, routine imaging is unnecessary. However, if pain persists for >90 days or is accompanied by aforementioned concerning features, then imaging is warranted. Plain radiographs can detect fractures and spondylolisthesis and certain malignancies such as myeloma. MRI is far more sensitive and detailed for evaluation of cord compression, herniated discs, radiculopathy, lumbar stenosis, and degenerative spine disease. Figure 1 demonstrates MRI findings in a normal lumbar spine and in severe spinal stenosis. Gadolinium contrast-enhanced MRI is needed when assessing for malignancy or infection. Electrodiagnostic studies (nerve conduction studies and electromyography) can be helpful when considering radiculopathy or if any neurological deficits are found by history or exam. Because of the high prevalence of abnormal MRI findings in the lumbar spine, electrodiagnostic studies can assist in distinguishing which abnormality is causative for the symptoms, and degree of acuity or chronicity, especially if surgical intervention is under consideration. Laboratory evaluation is helpful only if a systemic disease is suspected as a cause.

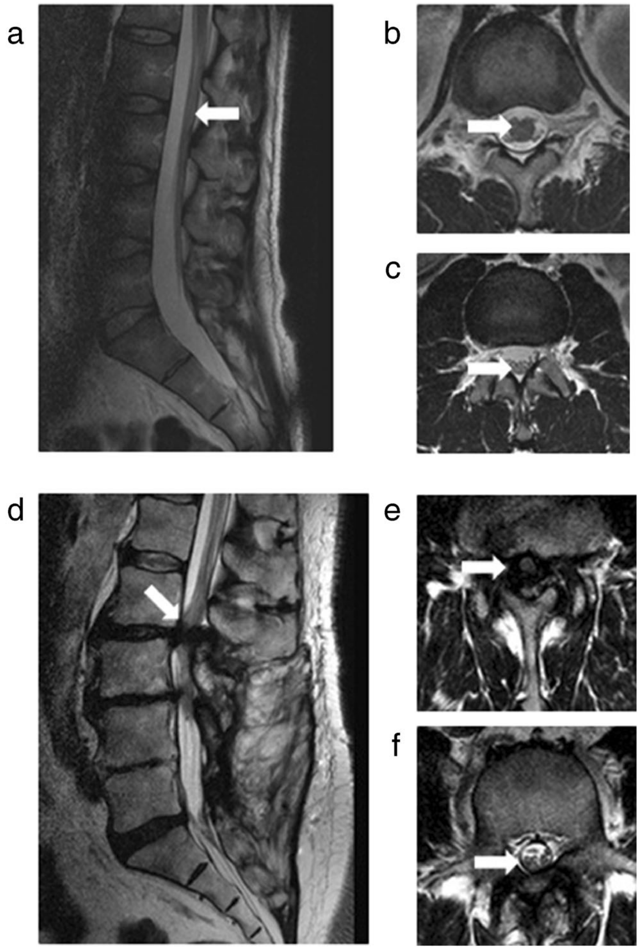

Fig. 1 Magnetic resonance imaging of the lumbar spine. *Top panel* (**a**, **b**, **c**): normal lumbar spine MRI; **a** sagittal T2-weighted image demonstrating lower spinal cord, lumbosacral roots (*arrow*), and surrounding bright cerebrospinal fluid (CSF), **b** axial T2-weighted image demonstrating lower spinal cord (*arrow*) surrounded by CSF, and **c** axial T2-weighted image showing lumbosacral nerve roots (cauda equina, *arrow*) surrounded by CSF. *Bottom panel* (**b**, **e**, **f**): lumbar spine MRI findings in severe lumbar spinal stenosis; **d** sagittal T2-weighted image showing compression of the lower spinal cord and roots (*arrow*) with no surrounding CSF, **e** axial T2-weighted image showing lower spinal cord compression with no surrounding CSF visible (*arrow*), and **f** lower down the lumbosacral nerve roots are visible within CSF below the area of severe stenosis (*arrow*)

Treatment

The treatment of back pain is multimodal. The goal of pharmacologic treatment is to reduce inflammation and provide analgesia. Physical therapy increases strength, range of motion, and mobility and prevents falls. Lifestyle modifications, such as weight loss and treatment of underlying or comorbid disease, are also helpful. Special considerations are necessary in the elderly. While for quite some time bed rest was advised, numerous randomized controlled trials have demonstrated the extent and rate of recovery from acute back pain were similar with or without bed rest. In addition, there may be some evidence that patients placed on bed rest may do slightly worse than those who are not [23]. Maintaining activity is important in managing back pain.

Pharmacologic Treatment

Treatment of lower back pain in the elderly depends in part on the severity of pain, etiology, and comorbidities in the patient. Nonsteroidal anti-inflammatory drugs (NSAIDs) are commonly used for the short-term (2–4 weeks) treatment of back pain. Systematic review of trials of NSAIDs for back pain showed more improvement in symptoms after 1 week compared to placebo and similar efficacy with acetaminophen. However, there were more side effects with NSAIDs than with acetaminophen or placebo [24]. There are, however, adverse effects of NSAIDs, most significantly nephrotoxicity which is of greater concern in the elderly. Gastrointestinal (GI) irritation is also common, and there is increased risk of GI bleeding especially in those with peptic ulcer disease. COX-2 selective NSAIDs have been associated with increased risk of cardiovascular events in certain populations and are used judiciously. Risk of all side effects is greater in the elderly, in large part, due to comorbid renal, gastrointestinal, and cardiovascular diseases.

Acetaminophen can be used for analgesia for those who cannot tolerate or have contraindications to NSAIDs. The main concern with acetaminophen is the risk of hepatotoxicity. While the risk is dose-related, the actual dose at which toxicity occurs can vary from person to person. Risk is increased in those with frequent alcohol use, known hepatic disease, and those taking other medications that have acetaminophen as an ingredient. In healthy persons, the general recommendation is a maximum of 4 g per day, and 2 g per day in those who use alcohol. Hepatic enzyme measurements in healthy persons taking 4 g/day of acetaminophen for 10 days found that over 50 % developed mild asymptomatic elevations [25], and a randomized controlled trial found that mild elevations mostly resolved by 16 days of continued treatment [26•].

Centrally acting skeletal muscle relaxants provide analgesia, sedation, and muscle relaxation. Agents in this category are diverse and include benzodiazepines, cyclobenzaprine, methocarbamol, carisoprodol, baclofen, chlorzoxazone, metaxalone, orphenadrine, and tizanadine. These have been shown to provide better than placebo pain relief in the short term but were also associated with more adverse events [27]. The primary adverse effects of muscle relaxants relate to their central nervous system activity: sedation and dizziness are common to all drugs within this class. Cyclobenzaprine, methocarbamol, and carisoprodol also have anticholinergic properties. Given the concern for sedation, dizziness, and anticholinergic effects, these agents as a class are generally not recommended for the elderly.

Opioids are another option for short-term analgesia. Side effects of sedation, respiratory depression, misuse/abuse, urinary retention, and constipation underscore the need to use caution, especially in the elderly. Studies show that up to around 20 % of elderly with chronic pain are prescribed short-term opioids and experience relief. However, data regarding safety and efficacy in the elderly are conflicting, which may be due to comorbidities in subpopulations studied [28, 29].

For chronic back pain with neuropathic features, neuropathic pain medications may be prescribed. There are numerous choices in the categories of antiepileptics and antidepressants. Polypharmacy, medication interactions, and comorbidities must be considered. However, gabapentin and pregabalin have the fewest interactions and side effects and can be used safely in the elderly. In general, it is best to initiate therapy at lower starting doses with slow up-titration with careful monitoring of side effects (mainly drowsiness and dizziness). Another option is duloxetine, which can be beneficial both for pain and depression. Tricyclic antidepressants are also helpful for back pain, but should only with vigilant monitoring in the elderly and at very low doses given the potential risk for arrhythmias and anticholinergic effects.

Each of the aforementioned medications must be carefully considered for a particular patient, weighing risk profile, and potential benefits. The elderly are more susceptible to adverse events due to metabolic changes and decreased drug clearance. Medications affecting the central nervous system may be associated with increased falls and cognitive compromise, especially in the elderly. The Beers Criteria provide recommendations on particular classes of medications in the elderly; certain medications to always be avoid, some which are inappropriate in certain situations, and others which should be used with caution. In particular, NSAIDs are recommended to be used on a short-term basis only and prescribed with a proton-pump inhibitor. Muscle relaxants should generally be avoided given the sedating and anticholinergic effects. Lower doses are often needed for all of these medications. A balance is required between over- and under-prescribing [30•].

Non-pharmacological Treatments

Physical therapy is an essential intervention for back pain. The goal is to improve mobility, strengthen muscles, and increase range of motion. Patients may also benefit from referral to rehabilitation specialists, who include additional noninvasive therapies such as transcutaneous electrical nerve stimulation (TENS) or orthotics [4]. A specific program of manual therapy to induce analgesia followed by a program of active exercises was shown in a randomized controlled trial to reduce functional disability and pain intensity in patients with back pain [31]. Perhaps not surprisingly, the quality of the physical therapist-patient relationship affects outcome for chronic lower back pain [32•]. Corticosteroid injections to the facet joints may help some patients as well.

Acupuncture may be of mild benefit to some [33] but is difficult to study in a controlled fashion. Other practices reported to be helpful are yoga, meditation, spinal manipulation, and massage. New directions under investigation for treating back pain include chiropractic treatment [34], cognitive behavioral therapy, and peripheral nerve field stimulation.

For the common, uncomplicated back pain, no surgical intervention is needed. However, for severe, chronic back pain associated with lumbar spinal stenosis, or neurological compromise, neurosurgical referral for evaluation for surgical decompression is indicated. There is a collection of literature on spinal surgery in the elderly and factors associated with outcomes, which is beyond the scope of this review [35•, 36, 37].

Conclusions

In summary, back pain in the elderly is a common problem, with numerous risk factors and associated comorbidities. A majority of back pain is uncomplicated and due to mechanical cause, and a thorough clinical history and examination is imperative to identifying underlying conditions requiring urgent attention. Treatment is multifaceted and tailored to the particular patient but entails a combination of physical therapy and analgesia. It is important to recognize and treat the elderly with back pain in order to maintain quality of life and reduce morbidity and mortality.

Compliance with Ethics Guidelines

Conflict of Interest Christina M. Ulane declares that she has no conflict of interest.

Human and Animal Rights and Informed Consent This article does not contain any studies with human or animal subjects performed by any of the authors.

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