Principles of Orthopedic Practice for Primary Care Providers

Jeffrey N. Katz
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Foreword

More than a third of symptoms and complaints reported to primary care physicians are musculoskeletal in nature. Therefore, primary care providers are the frontline clinicians for most orthopedic and musculoskeletal disorders. The basic premise of this book *Principles of Orthopedic Practice for Primary Care Providers*, edited by Drs. Katz, Blauwet, and Schoenfeld, is to provide a concise educational tool and quick reference to primary care providers in order to give them a framework for diagnosis and early treatment of common musculoskeletal disorders. The editors have put together a comprehensive collection of chapters that provide an overview of the most common disorders that affect the upper and lower extremities as well as the spinal column. A primer on basic physical examination of the various musculoskeletal systems and imaging guidelines are nicely organized and presented for practical application. The general practitioner should be able to develop a differential diagnosis quickly and then determine when a referral to a specialist may be indicated for more definitive treatment.

One unique feature of this book is that all the senior authors are faculty of the Brigham and Women's Hospital and Harvard Medical School. Most of the senior authors are nationally and internationally acclaimed experts in orthopedic surgery, physical medicine and rehabilitation, and rheumatology. The interdisciplinary nature of this book by the surgical and nonoperative experts in musculoskeletal medicine should provide a balanced approach to these common entities for which our patients seek care. This book should help fulfill our goal of providing the highest quality patient care as all health care providers become more educated and efficient in the way they handle patients with musculoskeletal disorders.

Boston, MA, USA James D. Kang

Preface

Musculoskeletal disorders are prevalent, disabling, and costly. In fact, the direct medical and disability costs associated with musculoskeletal disorders exceed 3% of the gross domestic product in the USA, with similar impacts in other Western countries. These disorders occur in people of all ages, races, and ethnicities, lasting days in some instances and a lifetime in others.

Our capacity to diagnose these conditions accurately and treat them effectively has expanded dramatically over the last several decades with the use of advanced imaging and sophisticated rehabilitative and surgical approaches. Technological advances notwithstanding, the foundation of quality musculoskeletal care remains to be careful history taking and physical examination coupled with an understanding of the differential diagnosis and natural history of common musculoskeletal disorders and the circumstances in which referral to musculoskeletal specialists is appropriate.

Patients with musculoskeletal problems generally seek care from their primary care providers, who must make the critical initial assessment of the diagnosis, treatment pathway, and necessity for further testing and referral. This is a tall order. We are musculoskeletal specialists who work closely with our community of primary care providers. We created this book to help primary care providers everywhere develop greater comfort with the recognition and early management of the more prevalent musculoskeletal disorders. The chapter authors are active clinicians with practices based at Brigham and Women's Hospital in Boston.

The book includes chapters on disorders affecting the spine, the upper extremities, and the lower extremities. Within each of these broad anatomic categories, individual chapters focus on one or a cluster of related entities. Each chapter covers the clinical presentation of the problem(s), differential diagnosis, indications for diagnostic testing, evidence-based recommendations for initial nonoperative treatment, and indications for surgical referral.

We are privileged to work with and learn daily from a community of dedicated primary care providers and of superb musculoskeletal specialists, many of whom are chapter authors of this volume. We are further privileged to care for a vibrant community of patients in the Boston area, who teach us more about musculoskeletal disorders each day. Finally, we are privileged to have the support of our loving families and in particular of our spouses—Susan Zeiger, Erin Schoenfeld, and Eli Wolff.

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Part I
Axial Spine

Chapter 1
Axial Neck and Back Pain

Jay M. Zampini

Abbreviations

AP	Anteroposterior
ASIS	Anterior-superior iliac spine
CT	Computed tomography
FABER	Flexion-abduction-external rotation
MRI	Magnetic resonance imaging
SI	Sacroiliac
SPORT	Spine Patient Outcomes Research Trials.
PT	Physical therapy

Introduction

Greater than 80% of all adults will, at one time or another, experience back pain debilitating enough to impair activities of daily living, occupational performance, or quality of life. Although the lumbar spine is affected more frequently than the cervical or thoracic regions, pain that affects any segment of the spine can be termed "axial spinal pain" and should be distinguished from conditions with neurogenic pain such as neurogenic claudication and radiculitis. The pathophysiology and treatment of axial spinal pain differ from that of the neurogenic conditions, though the two may be present concomitantly. This chapter will review the pathophysiology, evaluation, and treatment of axial pain in the neck, the back, and the sacroiliac (SI) joints. The term "axial pain" will be used when referring generically to any segment of the spine. "Neck pain," "back pain," or "SI pain" will be used when referring specifically to the neck, back, or SI joints, respectively.

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Definition and Epidemiology

Axial pain is defined as pain localized to one or more regions of the spine and/or SI joints without radiation into the lower extremities. It typically is present at all times and not necessarily aggravated by ambulation or activity. Pain may be lessened with rest or lying flat, but this does not have to be the case and is not required for a diagnosis. There are a number of factors that may be responsible for axial pain including joint dysfunction, degenerative changes, trauma, tumor or infection, myofascial structures, and nonorganic pain generators.

With greater than 80% of the adult population experiencing axial spinal pain at some point in life, and many not seeking medical care, it is difficult to make conclusive epidemiologic statements about populations at risk. It can almost be stated that anyone who lives long enough is at risk for back pain. Certain factors are known to associate with a higher risk of chronic axial pain, including obesity, tobacco use, total body vibration as may occur in long-distance truck driving or use of a jackhammer, and repetitive hyperextension activities of the lumbar spine.

Clinical Presentation

Pain History

The evaluation of axial spinal pain is no different than any other pain evaluation and should include the time of onset, location of maximal pain, duration, severity, and associated symptoms. An inciting event should be noted if possible. A patient should be asked to consider events in the 2–3 days preceding the onset of pain since the inflammation which often causes axial spinal pain will increase over this time period. Body positions or maneuvers that exacerbate or alleviate the pain should be sought as should other associated symptoms. Patients should also be queried as to whether similar symptoms have presented in the past.

A thorough axial pain evaluation is then performed, with consideration given to the structures that may be pain generators. All spinal structures can potentially cause pain. These structures include the vertebral body and disc in the anterior spine; facet joints, other bony processes, interspinous and supraspinous ligaments, and SI joints posteriorly; as well as the myofascial tissue in all spinal regions (Fig. 1.1). As these structures each perform a unique function, they also possess characteristic patterns of pain that may be elucidated through the history and physical exam. The pain patterns typically associated with dysfunction of each key spinal structure are summarized in Table 1.1.

The history of axial pain should clearly document the presence or absence of any “red flag,” signs, and symptoms. A history of acute, high-energy trauma, such as car accidents or falls from greater than standing height, would suggest the need for emergent evaluation. Constitutional symptoms such as unintended weight loss in

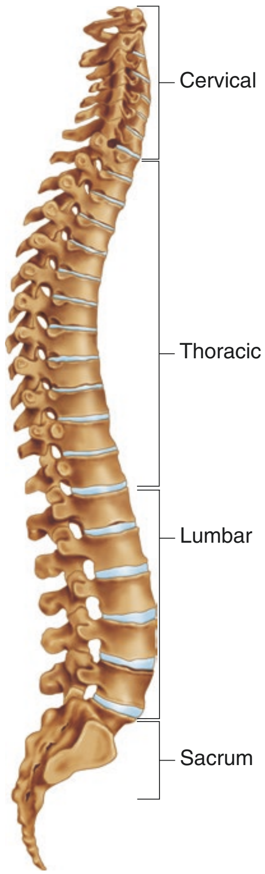

Fig. 1.1 Schematic of the human spine. The spine contains four zones: cervical, thoracic, lumbar, and sacrum

excess of 10% of body weight or unexplained fevers or chills would suggest the need for a neoplastic or infectious workup. Other neurologic "red flags," such as bowel or bladder retention or incontinence, should be sought to identify potential neurologic emergencies.

Physical Examination

A specific diagnosis of axial pain can be made most often by the history alone. The physical examination serves to confirm the expected diagnosis. For most patients it is useful to examine all aspects of the spine not expected to be painful before focusing on the structure anticipated to be the pain generator since the examination is sure to exacerbate the pain at least temporarily. Any involuntary guarding associated with increased pain can obscure other aspects of the evaluation such as the neurologic examination. Examination of the sensory, motor, and reflex functions can

Table 1.1 Pain patterns typically associated with dysfunction of key spinal structures

	Myofascial	Fracture	Discogenic	Facetogenic	Sacroiliac
Injury identified	No	Yes	No	No	No
Tenderness	Trigger point	Focal	No	Focal	Focal
Exacerbating factors	Muscle stretch or activation	Spinal motion	Prolonged sitting or standing	Spinal hyperextension	Forced SI joint motion
Alleviating factors	Muscle rest	Immobilization	Recumbency	Recumbency	Recumbency
Neurologic symptoms	None	Possible	Possible	Possible	None
Referred pain[a]	None	Possible	Possible	Possible	Possible

[a]Cervical spine conditions can cause referred pain between the occiput and the lower scapulae, depending on the spinal level of the condition. Lumbar conditions can cause referred pain to the buttock and posterior thighs

often be performed first and without any additional discomfort to the patient. This should be followed by a standing examination of the spine. Spinal curvature and posture should be evaluated with attention to shoulder height, pelvic obliquity, and any deviation of spinal balance. Spinal balance generally means that the patient's head is centered over the pelvis in both the sagittal and coronal planes. Gait should be examined from this position as well; attention should be paid to voluntary and involuntary alteration of gait to avoid pain and to any assistance device required for mobility. In the standing position, the spine should be palpated in the midline to determine if any bony tenderness is present. The musculature should be palpated next, again focusing on areas not expected to be tender before palpating potentially painful muscles. Spinal motion should be assessed last as this is often most painful for the patient. Objective measurements of spinal flexion, extension, lateral bending, and rotation, while valuable to document objective responses to treatment, are typically not as helpful for diagnostic purposes.

Next, provocative maneuvers should be performed for diagnostic confirmation if necessary. For axial spinal pain, provocative maneuvers are most useful for confirming the SI joint as the source of pain. A patient should be supine for most of these tests. One sensitive test of the SI joint is performed by passively flexing the hip on the painful side and then abducting and externally rotating the hip while the contralateral leg remains on the examination table. This maneuver—flexion-abduction-external rotation (FABER) test—compresses the ipsilateral SI joint and reproduces pain as a result. The test is positive if pain near the SI joint is reproduced. The test is nonspecific, however, since several structures are manipulated simultaneously (the hip joint, SI joint, lumbar spine, musculature) and should be followed by other confirmatory tests. If pain at the SI joint can be reproduced by compressing the pelvis either by using bilateral, posteriorly directed pressure on the anterior-superior iliac spines (ASIS) in the supine position—the AP pelvic compression test—or by pressure on the greater trochanter with the patient in the lateral decubitus position (the lateral pelvic compression test), then the painful structure can be confirmed to be the SI joint. Additionally, the SI joint can be examined by sliding the supine patient to the side of the exam table, flexing the hip on the non-painful side, and hyperextending the hip on the painful side in what is called a Gaenslen's maneuver. Reproduction of pain is a positive finding. A final aspect of the physical examination includes evaluation of other potentially painful joints in the upper or lower extremities.

One further consideration in the examination of a patient with axial pain is the impact of psychological somatization and symptom magnification. These patients will perceive pain that is either present without any physical disruption of a spinal structure or out of proportion to what would be expected by the physical condition. To make this determination requires a nuanced approach to patient evaluation; several classic findings, termed Waddell's findings, have been reported to correlate with somatization and symptom magnification. Gentle downward compression of a patient's head does not cause any motion of the lumbar spine and should, therefore, cause no low back pain. Similarly, if spinal motion is simulated—with rotation of the shoulders, back, and pelvis at the same time—the spine itself is not affected and no pain should be experienced. Finally, light touch of the skin overlying the spine should not produce pain. Observation of pain with any of these maneuvers should alert the clinician that nonorganic factors are contributing to the patient's pain and should be taken into account when planning further evaluation and treatment.

Differential Diagnosis and Diagnostic Testing

Myofascial Pain

Muscles are the structures most susceptible to fatigue and overuse injury as well as to injuries resulting from acute demand exceeding muscle capacity. These injuries collectively comprise the most common cause of spinal pain and are generically called strains. Activation or passive stretch of the injured muscle will exacerbate the pain. Palpation will reveal focal, typically unilateral tenderness at the site of muscle injury. Multiple painful triggers may be encountered in the paraspinal musculature of patients with myofascial pain syndromes, such as fibromyalgia. Imaging does not help confirm a diagnosis, but does rule out other potential etiologies as a cause of the pain.

Pain Associated with Fractures and Ligamentous Injuries

In both young and old patients, referred pain can be felt in a pattern characteristic of the level of injury. Injuries close to the upper cervical spine will have referred pain to the occiput; injuries of the lower cervical spine will have referred pain even as far distally as the lower aspect of the scapulae. Similarly, lumbar fracture patients can complain of referred pain to the buttocks or upper thighs. Dermatomal symptoms to the hands or feet do not represent referred pain and suggest that a full neurologic exam should be included. Palpation reveals focal tenderness at the sight of injury. Plain film or computed tomographic (CT) imaging is used to diagnose or confirm a fracture. Magnetic resonance imaging (MRI) may be required if these initial studies are negative, to evaluate for concomitant disc or ligamentous injury, or to assess the acuity of a particular fracture.

Discogenic Pain

Several painful conditions have been shown to localize to the disc: tears of the annulus, herniated discs, and degenerative disc disease (Fig. 1.2). With an annular tear, patients complain of axial pain deep inside the spine and focally at or near the injury site. Pain is typically increased with lumbar flexion or sitting and relieved with lumbar extension or lying flat. Plain film images may be read as negative depending on the extent of degenerative changes involving the disc space (Fig. 1.3). MRI is the diagnostic test of choice and will accurately display the amount of disc degeneration at various levels within the spine (Fig. 1.4). As a result, this imaging modality is nonspecific and cannot identify which, if any of the degenerative discs identified, is the cause of a patient's axial pain.

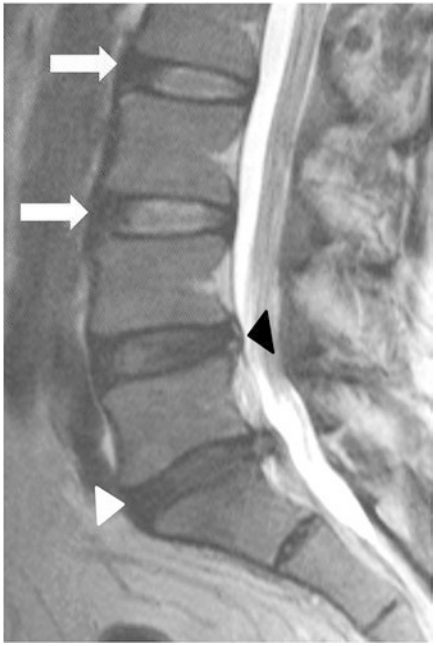

Fig. 1.2 This sagittal, T2-weighted MRI of the lumbar spine shows normal (*white arrow*) and degenerative discs. The degenerative discs show decreased disc height and low disc signal from loss of disc hydration (*white arrow head*) and annular tearing (*black arrow head*)

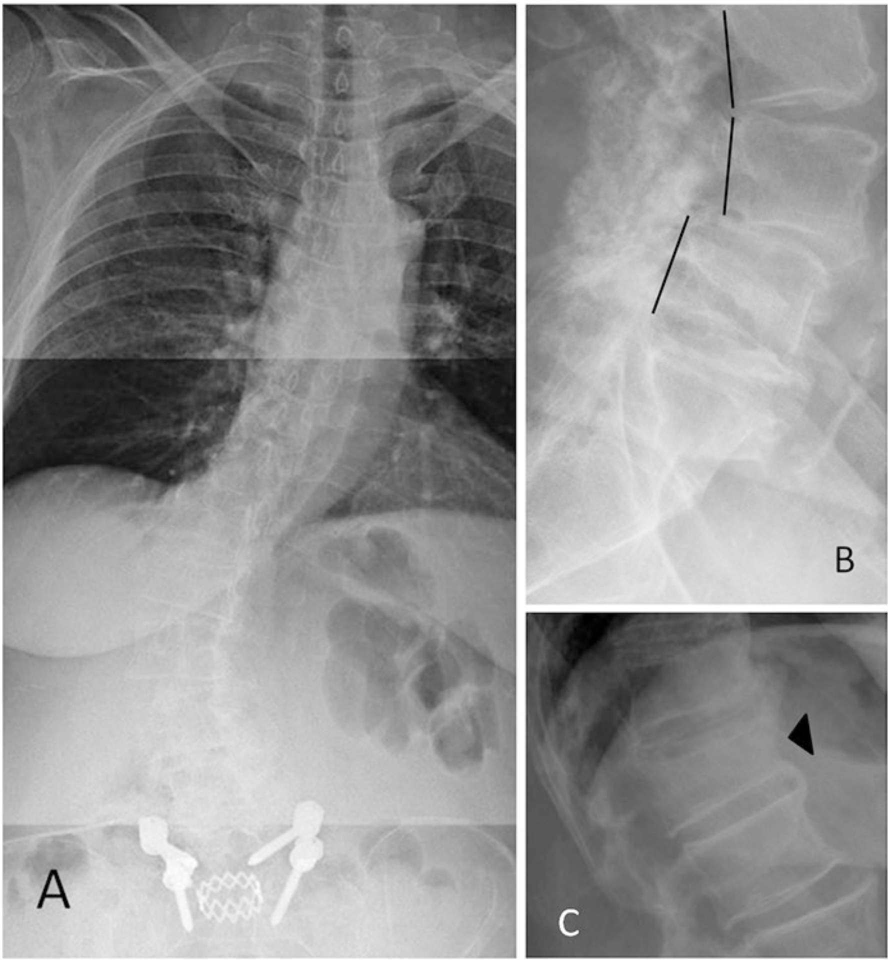

Fig. 1.3 Planar radiographs of the lumbar spine are ideal to identify and monitor scoliosis (**a**), spondylolisthesis (**b**), and compression fractures (**c**)

Facetogenic Pain

Patients with painful, degenerative facet joints will complain of morning pain and stiffness of the back. Spinal extension increases the load borne by the facet joints, and patients will complain that this maneuver exacerbates the pain. Referred pain is often present with painful facets: upper cervical facet referred pain may be perceived along the occiput with lower cervical referred pain felt in the shoulders or scapulae. Lumbar referred pain is perceived within the buttocks, pelvis, or posterior thighs. Spinal extension may increase the sensation of referred pain. It should be noted that the discs and facet joints age or degenerate concomitantly and may be

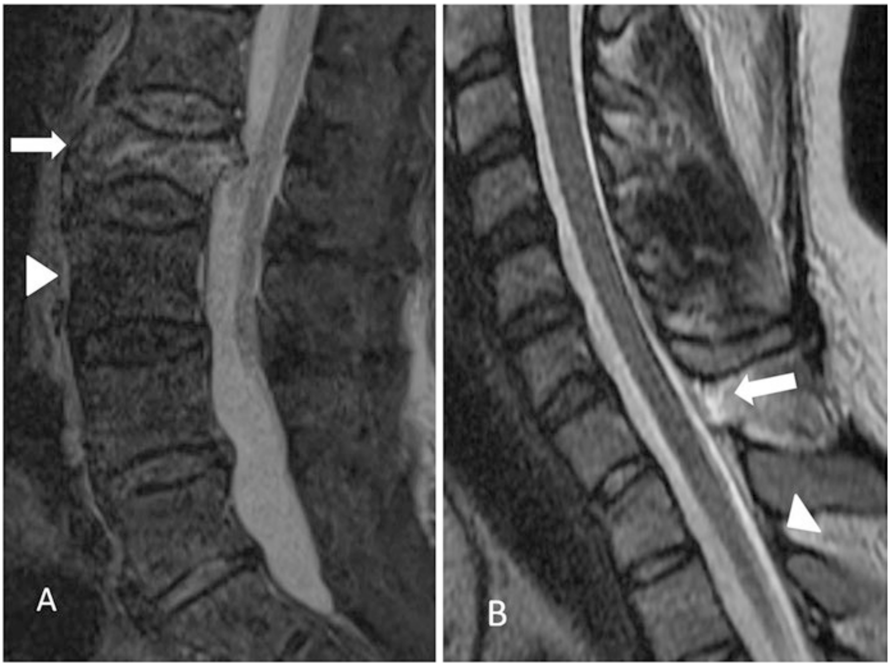

Fig. 1.4 MRI is useful for identifying the source of axial spinal pain including occult fractures (**a**) and ligament sprains (**b**). The occult fracture (**a**) is identified by the high STIR signal in the vertebral body (*arrow*) compared to low signal in an uninjured vertebra (*arrow head*). The ligament injury (**b**) is shown at the arrow compared to a normal-appearing ligamentum flavum seen at the level below (*arrow head*).

symptomatic simultaneously. These patients will note that prolonged sitting and standing both exacerbate pain. Plain film, CT, and MR imaging can all demonstrate evidence of facet arthrosis, although none of these imaging modalities are considered a specific test.

Sacroiliac Pain

The SI joints form the link between the spine and pelvis. The joints are extremely stable as a result of strong ligaments on both the posterior and anterior aspects of the joint. Patients with painful sacroiliac joints complain of pain just medial to the posterior superior iliac spines, the bony prominences at the top of the buttocks. Patients may experience pain with lumbosacral range of motion, ambulation, or single-leg stance. The unique location and function of the SI joints allows for a somewhat more focused examination than for other degenerative spinal conditions. At least three other provocative maneuvers (FABER test, thigh thrust, Gaenslen's test, and/or pelvic compression) should be positive to confirm SI pain with relative certainty. Plain film images and CT scans may show joint degeneration, while active inflammation or synovitis can be appreciated on MRI. The extent of findings localized to the SI joint does not necessarily correlate with the degree of a patient's SI-related pain.

Conditions Causing Referred Pain to the Spine

All evaluations of axial spinal pain should consider non-spinal sources as well. Visceral, vascular, autoimmune, neoplastic, and infectious conditions are responsible for 2–3% of all axial spinal pain. These conditions often cause nonmechanical pain or pain that does not change with spinal motion. Patients will report that they "just can't get comfortable in any position." Red flag signs and symptoms should be sought in these patients with a concomitant vascular examination as deemed necessary.

Nonoperative Management

A large majority of patients with newly diagnosed axial pain will return to their baseline state of spinal health within 4–6 weeks, oftentimes with little to no treatment. For this reason, noninvasive, nonoperative modalities are the preferred choice for the treatment of axial spinal pain.

For patients with acute spinal pain—whatever the underlying origin—a short period of rest from aggravating maneuvers is indicated. A patient should not be placed on complete bed rest for more than 1–2 days. After even a few days of bed rest, the musculature of the entire body including the paraspinal muscles will begin to atrophy, making effective rehabilitation a challenge. The patient should be advised to return to activity as soon as possible with avoidance of the most painful activities. Additionally, nonsteroidal anti-inflammatory drugs should be prescribed at an appropriate dose for the purposes of pain relief. An oral steroid taper can also be used but should be used with caution, as several reports have suggested that oral steroids may reduce the efficacy of later, more invasive treatments such as injections.

By 2–4 weeks following symptom onset, most patients will have recovered sufficiently to resume most activities of daily living and even more strenuous activities such as exercise. It is at this point that physical therapy (PT) can be helpful to further reduce pain and to begin rehabilitation and prevention of future exacerbations. Therapists can perform pain-relieving treatments including massage, stretch, and spinal manipulation to accelerate pain reduction. This phase of treatment may also include chiropractic care and acupuncture. The long-term goals of PT should focus on improving muscle strength. Patients with muscle strains require strengthening of the injured muscle and all muscles that support the spine (known as the "core" musculature) to become better able to participate in the activities that initially precipitated the pain. Even patients with annular tears, herniated discs, and degenerative conditions can benefit from the trunk stability provided by strengthening the paraspinal musculature. Using one or more of these three noninvasive treatments, greater than 90% of patients should experience relief of acute axial pain, and many should experience long-term maintenance of spinal health.

Patients who fail to achieve relief of axial spinal pain through activity modification, oral agents, and therapy often can be treated with spinal injections. Injection techniques vary and are chosen for the specific pathology to be treated. Chronic muscle strains or muscle spasm may benefit from trigger point injections at the point(s) of maximal muscle tenderness. Recalcitrant cases of muscle spasm, particularly with cervical torticollis, are sometimes treated with injection of botulinum toxin (Botox, Allergan, Dublin, Ireland).

Axial pain thought to result from the disc or facet joints can be treated with epidural and perifacet injections, respectively. Epidural injections typically involve localization of the affected spinal level on fluoroscopy followed by injection of lidocaine and a corticosteroid. Immediate reduction of the pain with the effect of the topical anesthetic agent confirms the target as a pain generator. Epidural injections are best reserved for pathology within the spinal canal—disc herniations and occasionally annular tears. Patients with facet pathology benefit from perifacet injections. These injections can be placed directly into the facet capsule; however, most pain specialists now inject anesthetic cranially and caudally to the facet to block the medial branch of the dorsal primary ramus of the nerve root, the main innervation of the joint. These medial branch blocks have been found to be safer and more effective for reduction in pain emanating from the facets. Additionally, medial branch blocks can be used to plan radiofrequency denervation of the facet joint, a technique that offers longer-term relief of facet-based pain in well-selected patients.

For individuals with painful SI joint dysfunction, injections directly into the joint may be beneficial. A pain specialist or interventional radiologist will identify the SI joint on fluoroscopy and advance a needle into the joint. Following fluoroscopic confirmation, a topical anesthetic agent and a corticosteroid are injected. In 80–90% of cases, well-selected patients will experience some degree of pain relief following the injection.

Aside from pain relief, two other benefits are provided through spinal injections. First, if a patient experiences partial relief with the injection, he or she may be better able to participate in therapy. The two modalities can then work synergistically to accelerate a patient's recovery. Second, the application of a topical anesthetic agent or corticosteroid can help to predict if a patient will respond favorably to surgery. Temporary but substantial relief of symptoms implies that a more permanent treatment option, namely, surgery, could be considered.

Indications for Surgery

Surgery is not indicated for the vast majority of patients with axial neck and back pain for several reasons: the condition is often not amenable to surgery (e.g., muscle strain, ligament sprain), the condition is stable and self-limited (e.g., most compression fractures and nearly all spinous process and transverse process fractures), or imaging findings are too diffuse to determine which process represents the main pain generator (e.g., multilevel degeneration with axial pain). Surgical treatment of axial pain is currently well indicated for patients with scoliosis and kyphosis, spondylolisthesis, and spinal instability resulting from fractures and dislocations. Surgical intervention for degenerative disease with axial pain in the absence of neurogenic symptoms is rarely indicated and only if the degeneration is localized, patients have failed to achieve sustained pain relief with nonoperative modalities, and significant clinical information can confirm that the degenerative conditions identified are the sole pain generators. The clinical information best able to predict a positive outcome following surgery is the observation of complete (or near-complete) resolution of axial pain with focal spinal injections coupled with consistent, reproducible physical examination findings pointing to the degenerative structures as pain generators. Additionally, the patient's history should be free of other psychosocial factors that could confound treatment. These factors include psychiatric conditions with predominant somatization symptoms, presence of active litigation related to an injury associated with the pain (e.g., car accidents, work-related injuries), and the presence of an active worker's compensation claim.

Operative Management

One of the most compelling reasons to avoid surgery for axial pain, if at all possible, is that fusion-based procedures are the primary treatment for these conditions. The main rationale for fusion follows the logic that pain from a moving structure can be controlled by eliminating motion at the structure. In all segments of the spine and SI joints, fusion involves preparing the environment surrounding two bones to be conducive for the growth of new bone. The bridging bone will then join the two initially independent segments into a single structure.

Anterior Spinal Fusion

Spinal fusion can be performed from an anterior approach to the disc space between the vertebral bodies. These operations are termed "interbody," or "intervertebral," fusions for this reason. The technique is most often used for anterior cervical spine surgery and in the lumbar spine for discogenic back pain. Anterior fusion enjoys the advantage of a large space for placement of bone graft for fusion between the well-vascularized vertebral bodies. Cervical spine surgery is readily accomplished in this manner with a relatively minimally invasive approach that exploits natural anatomic planes between the trachea, esophagus, and major neurovascular structures in the neck. Thoracolumbar surgery, however, has the disadvantage of requiring exposure through the thoracic and abdominal cavities with attendant risk of injury to the visceral and vascular structures contained therein. Bone graft, either from a cadaveric donor or harvested from the anterior iliac crest, is impacted into the space previously occupied by the intervertebral disc to achieve the fusion. This is typically stabilized using a metal plate affixed to the anterior aspect of the vertebrae with bone screws, as such instrumentation has been shown to provide more immediate stability and enhance the likelihood of fusion.

Postoperatively, patients often use a cervical collar or brace to protect the spine until pain begins to resolve. The fusion site will heal over the course of several months and is monitored using periodic radiographs. Visualization of bone bridging between the intended vertebrae signifies complete healing of the fusion.

Posterior Spinal Fusion

Thoracolumbar fusion is most commonly performed using a posterior approach. The advantage of the posterior approach in the thoracic and lumbar regions is that long segments of the spine can be accessed without violating the thoracic and abdominal cavities and complication rates are reduced as a result. Fusion can be achieved by placing an interbody graft using carbon fiber or titanium cages, cadaver bone, or autograft from the iliac crest or elsewhere. Stabilization is achieved via bone screws anchored to the vertebrae through channels created in the pedicles and connected by rods. Patients may be given a back brace to assist mobilization after thoracolumbar posterior fusion. The brace is typically used only until a patient's pain resolves and the muscles once again become able to assist stability. In patients with osteopenia or osteoporosis, a rigid brace may be prescribed for use until the fusion site shows signs of consolidation on radiographs.

SI Joint Fusion

Fusion of the SI joint requires debridement of the cartilage of the joint with replacement of the cartilage with bone graft. The SI joint can be accessed anteriorly or posteriorly with bone graft taken directly from the ilium. Stabilization is achieved using a plate bridging from the sacrum to the ilium or via percutaneously placed screws that span the joint space.

After SI fusion, patients are instructed to use crutches or a walker to assist in mobilization. Weight bearing on the operative limb is restricted to the so-called “toe-touch,” or “touchdown,” weight bearing for several weeks following surgery.

Expected Outcomes

The vast majority of patients (upward of 90%) with acute axial pain can be expected to experience pain relief within 6 weeks of symptom onset. Patients with initial episodes of pain can, therefore, be reassured that the pain will resolve and not result in a chronic condition. In general, the longer a patient experiences activity-limiting axial pain, the longer treatment will take to relieve the pain and the less likely he or she will be to experience complete pain relief. This observation was recently confirmed in an analysis of the multicenter Spine Patient Outcomes Research Trials (SPORT). Patients with lumbar disc herniations who experienced functional limitations for greater than 6 months were found to have inferior results, irrespective of treatment, as compared to patients in pain for less than 6 months. It is unclear if this finding suggests that patients developed chronic pain syndromes independent of the initial pain generator or if permanent structural damage to the spine was responsible.

If a patient is unable to achieve satisfactory relief through nonoperative measures, fusion-based procedures have been shown to result in long-term reductions in pain and improvement in function for only 60–70% of well-selected patients with axial neck and back pain. Reports of randomized trials and observational studies have shown that some well-selected patients could achieve pain relief and functional improvement following surgery. The selection process must be rigorous, however, in order to assure the best outcome possible. Ideally, patients should be free from nicotine products and should not be involved in litigation over the cause of pain to assure optimal outcomes. Patients must additionally be prepared to expect that no treatment will completely eliminate back pain. They should be counseled that pain reduction will approximate what was achieved with spinal injections and should be willing to accept that a 50% reduction in pain may be the best that can be achieved. Patients expecting full alleviation of pain following surgery should have their expectations appropriately adjusted through counseling from primary care physicians and surgeons prior to agreeing to any procedure.

Table 1.2 shows a summary of axial neck and back pain disorders with synopsis of presentation, diagnostic testing, and suggested management options.

Table 1.2 Summary of axial neck and back pain disorders with synopsis of presentation, diagnostic testing, and suggested management options

Clinical entity	Presentation	Diagnostic testing	Conservative management	Surgical indications and operative management
Myofascial pain	– Trigger point tenderness – Limited or no focal pain	– Primarily clinical	– Rest, ice, NSAIDS – PT – Trigger point injection	N/A
Fracture/ Ligamentous Injury	– History of trauma – Focal tenderness to palpation over injured region	– Plain films/ CT – MRI—if there is concern for ligamentous injury	– Rest, ice, NSAIDS – PT – Spinal bracing	– Spinal instability or failure of non-operative management with persistent pain – Spinal stabilization procedures often require instrumented fusion
Discogenic back pain	– Pain worse with sitting or standing – Forward flexion exacerbates the pain	– MRI—degenerative changes involving the discs (may not be diagnostic)	– NSAIDS – PT – Spinal injections	– Reserved for select cases where non-operative treatment fails – Fusion-based procedure
Facetogenic pain	– Pain worse with standing and ambulation – Extension exacerbates the pain	– MRI—degenerative changes involving the facet joints (may not be diagnostic)	– NSAIDS – PT – Facet injections, radiofrequency lesioning, rhizotomy	– Reserved for select cases where non-operative treatment fails – Fusion-based procedure
Sacroiliac pain	– Pain with single leg stance and ambulation – Positive provocative tests: FABER, Gaenslen's and/or pelvic compression	– Plain film/CT/ MRI—findings may not be diagnostic	– NSAIDS – PT – Sacroiliac injections, radiofrequency lesioning, rhizotomy	– Reserved for select cases where non-operative treatment fails – Fusion-based procedure

PT physical therapy, *CT* computed tomography, *MRI* magnetic resonance imaging, *NSAIDs* nonsteroidal anti-inflammatory drugs

Suggested Reading

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Part II
Cervical Spine