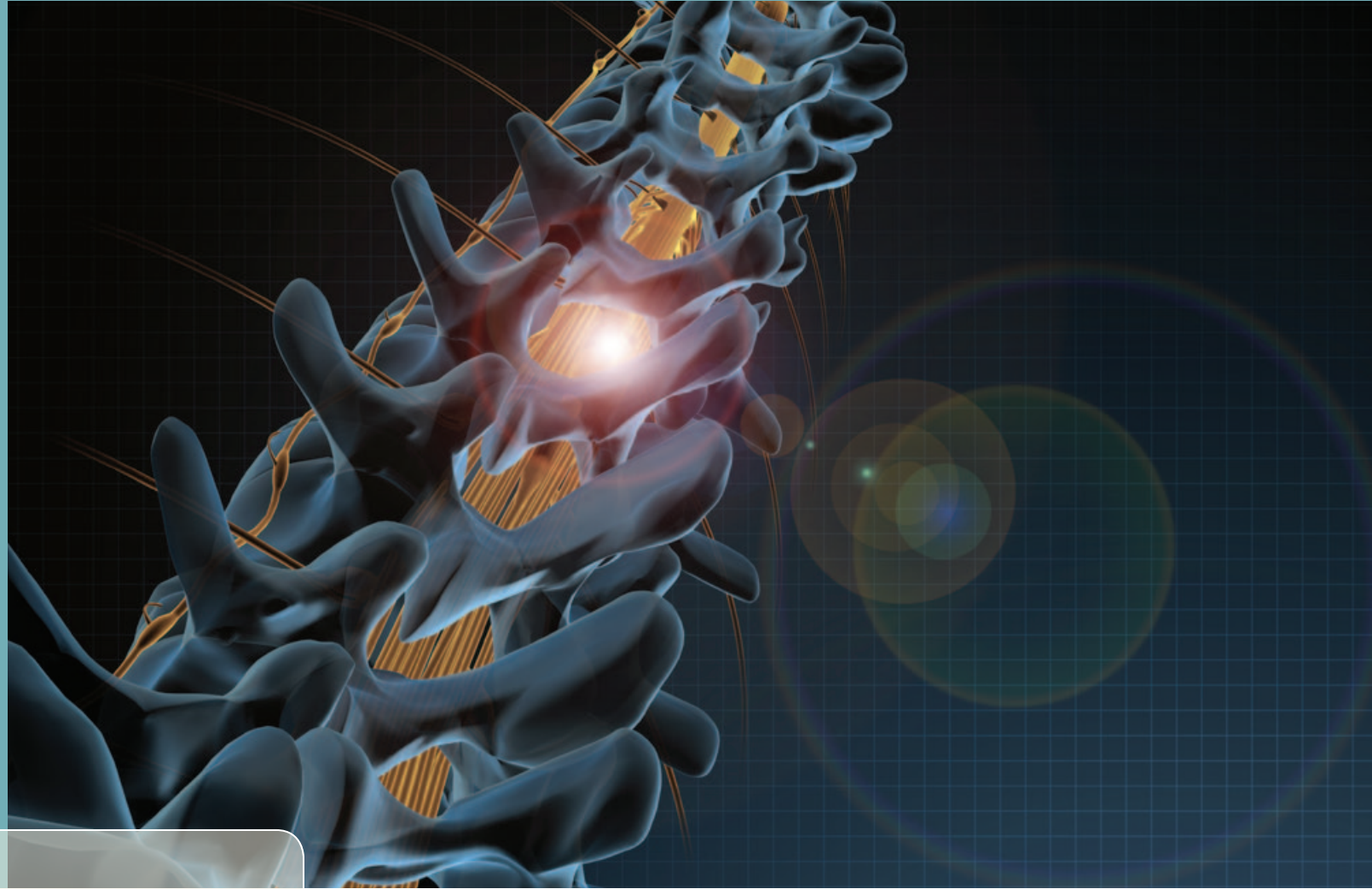


ucsf spine center



UCSF Medical Center
Spine Center

a single stop for

The UCSF Spine Center provides comprehensive treatment for all pathologies affecting the spine and peripheral nerves. Patients are treated by internationally recognized specialists in neurosurgery, orthopaedic surgery, neurology, and physiatry who work together to eliminate pain, restore function, and improve quality of life. The team also includes experts in cancer, pain management, physical therapy, radiation oncology, radiology, rheumatology, and nutrition.

This team approach, from initial diagnosis through treatment and recovery, is one reason why US News and World Report has ranked the UCSF Neurosurgery and Orthopedics Departments among the best in the nation. We are committed to excellence in patient care, to the education and involvement of physicians who refer their patients to our Center, and to advancing new therapies for spinal disorders.

Neurological Surgery



Christopher Ames, MD
Primary bone tumors; Spinal
deformity; Cranio-cervical junction



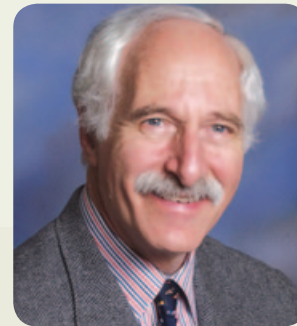
Nicholas Barbaro, MD
Peripheral nerve and pain
disorders; Chiari malformation;
Syringomyelia



Dean Chou, MD
Minimally invasive spine surgery;
Spinal deformity; Spinal tumors



Praveen Mummaneni, MD
Cervical spine surgery; Minimally
invasive spine tumor surgery;
Adult scoliosis surgery



Philip Weinstein, MD
Spinal stenosis; Meningeal
cysts and tumors; Spinal cord
arteriovenous malformations

total spine care

Orthopaedic Surgery



Sigurd Berven, MD
Spinal deformity; Spinal tumors;
Minimally invasive
spinal reconstruction



Shane Burch, MD
Spinal deformity;
Geriatric spine disease



Sibel Deviren, MD
Non-surgical treatments;
Fluoroscopy-guided
spinal injections



Vedat Deviren, MD
Spinal deformity; Minimally invasive
spinal reconstruction;
Spinal tumors



Serena S. Hu, MD
Spinal deformity; Spinal stenosis;
Disc replacements



Aenor Sawyer, MD
Pediatric and adult bone health;
Osteoporosis care and prevention



Bobby Tay, MD
Cervical and lumbar
spinal disorders;
Minimally invasive spine surgery

key collaborators

Anesthesia

Jeremy Lieberman, MD
Mark Rollins, MD, PhD

Intraoperative

Neuromonitoring

Russ Lyons, MS, DABNM
Roger Noss, PhD

Neuroradiology

Cynthia Chin, MD
William Dillon, MD
Christopher Dowd, MD

Neurology

John Engstrom, MD

Orthopaedic Bioengineering

Jeffrey Lotz, PhD

Otolaryngology

Ivan El-Sayed, MD

Pediatric Spinal Surgery

Mohammad Diab, MD
Nalin Gupta, MD, PhD

Pathology

Tarik Tihan, MD

Radiation Oncology

Igor Barani, MD

Thoracic Oncology

Thierry Jahan, MD

Vascular &

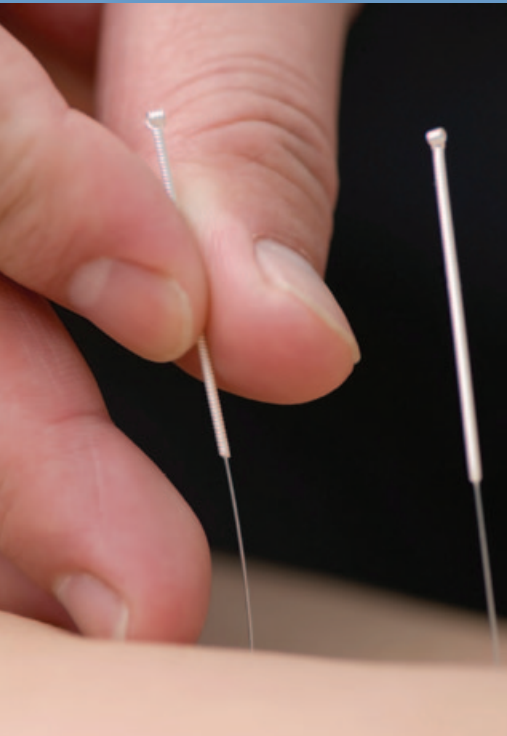
Endovascular Surgery

Charles Eichler, MD

non-surgical treatment

The first line of treatment for patients at the UCSF Spine Center is always a combination of non-surgical therapies. Patients with serious disorders, such as tumors, myelopathy, or instability, may be referred for surgical evaluation, but these patients are also evaluated by physiatrists and managed with non-surgical adjuvant therapy.

In a recent study at UCSF, 76% of patients with cervical disorders causing neck and radicular arm pain improved with conservative treatments, including cervical transforaminal epidural injection, physical therapy, and medication.



Non-surgical treatments are applied simultaneously from the beginning of treatment and include:

- Medications
- Physical therapy
- Ergonomics
- Patient education
- Transforaminal epidural steroid injections
- Facet joint intra-articular injections
- Sacroiliac joint intra-articular injections
- Medial branch nerve blocks

• Selective nerve root blocks
Experienced neuroradiologists perform a wide range of interventional and diagnostic therapeutic procedures, such as:

- Sciatic nerve blocks
- Sympathetic nerve blocks with anesthetics or botox
- Piriformis anesthetic injections
- Radiofrequency ablations
- Embolization of spinal vascular malformations

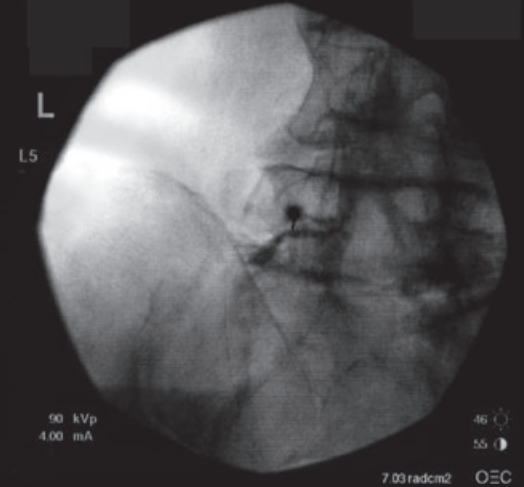
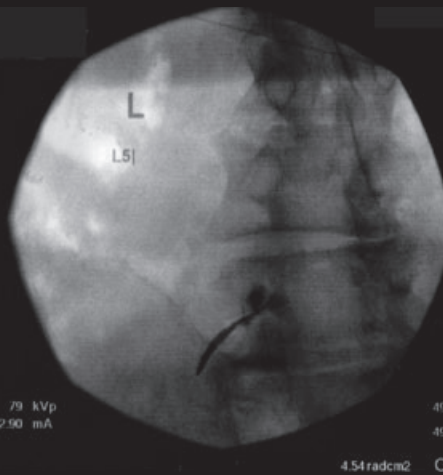
- Spinal angiography
- Discography

Additional diagnostic evaluations and non-surgical treatment options for functional movement problems or pain conditions of the neck and back are provided through our collaboration with the Osher Center for Integrative Medicine, including:

- Manual therapy by an experienced physician (including spinal manipulation if indicated)

- Massage by practitioners with experience in pain conditions
- Acupuncture following a diagnosis according to Traditional Chinese Medicine
- Biofeedback by an experienced nurse
- Hands-on mind-body interventions for psychosomatic pain conditions
- Group programs for Mindfulness-Based Stress Reduction, Yoga, and Tai Chi

atment



Transforaminal spread of radiopaque dye to confirm correct needle placement and to help localize the entrapment of the nerve root.

epidural steroid injections

An epidural steroid injection can be used not only to treat pain and reduce inflammation, but also for diagnostic and prognostic purposes.

Patients who receive 80% or greater relief from injections are 90-95% likely to benefit from surgery. Images taken for injections can be used to localize the source of pain and visualize the nerve roots. For patients with multilevel disorders, the injections can

help determine which level is the main pain generator. Symptoms can then be managed with less invasive surgery if the conservative treatments fail to improve function. Injections can also be used to resolve discrepancies between symptoms and imaging.

It has been shown that transforaminal epidural (TFE) steroid injections are more effective than interlaminar

epidural steroid injections, and are more selective and specific for localizing pain. TFE injections, under fluoroscopic guidance, are given where the nerve root is exiting the spine, allowing a greater percentage of the steroid to reach the ventral epidural space — the site of most inflammation — and enter the nerve root sleeve.

cervical transforaminal injections

Cervical transforaminal injections are done using digital subtraction angiography, allowing the physician to have a clear view of the spinal radicular artery to ensure that injections do not block

blood flow and result in complications. Over 2,000 cervical transforaminal injections and 10,000 spine injections have been performed at UCSF with no serious complications.



minimally invasive

Minimally invasive surgery is available for a number of spinal disorders, ranging from degenerative diseases to spinal tumors. These procedures have potential to greatly benefit patients by reducing surgical risk, pain, blood loss, risk of infection, and time to recovery. Our specialists have extensive training and

experience in minimally invasive spinal techniques, some of which can be performed in the outpatient setting. State-of-the-art instrumentation designed for these procedures allow for improved visualization and mobility.

minimally invasive techniques for the thoracic spine

Minimally invasive thoracoscopy techniques for anterior thoracic spine tumors use three to four small incisions through which the tumor can be removed. A voice-activated robotic arm aids in this surgery by following commands and helping to position the thoracoscopic camera for visualization. We are also one of the only centers in the United States to offer minimally invasive transpedicular thoracic discectomies and minimally invasive transpedicular corpectomies for tumors.

Indication

Herniated discs with cord compression

Fractures
Instability

Tumors

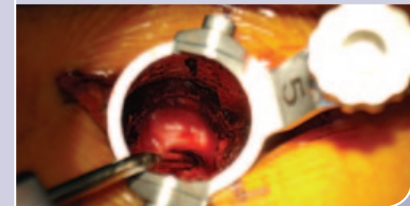
Minimally invasive transpedicular discectomy of the thoracic spine is performed through a tube just 26 mm in diameter.

Minimally Invasive Procedure

Transpedicular discectomy
Costotransversectomy

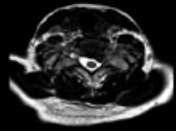
Fusion

Thoracoscopic robotic surgery
Posterior resection



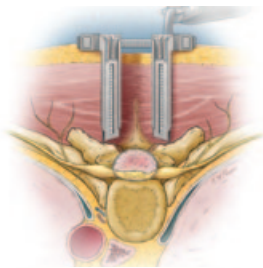
e surgery

minimally invasive techniques for the cervical spine	Indication	Minimally Invasive Procedure
<p>Using specialized tubular retractors and endoscopes that can move through tiny incisions, UCSF spine surgeons are able to treat cervical spine disorders with minimally invasive surgery.</p>	Herniated discs	Foraminotomy and Discectomy
	Degenerative spinal disease	Foraminotomy Fusion
	Fractures Trauma	Fusion
	Tumors	Decompression Resection



Axial T2 weighted MRI of the C7-T1 level showing a left-side disc herniation compressing the neural foramen. This disc herniation was subsequently removed with a posterior minimally invasive foraminotomy and discectomy.

minimally invasive techniques for the lumbar spine	Indication	Minimally Invasive Procedure
<p>A variety of advanced minimally invasive techniques are also available to treat the lumbar spine.</p>	Herniated discs	Discectomy
	Cauda equina syndrome	Lamino-foraminotomy
<p>Intradural tumor removal at T12-L1 through a minimally invasive expandable tubular retractor.</p>	Spondylosis/ Spondylolisthesis	Anterior lumbar interbody fusion (ALIF) Transforaminal lumbar interbody fusion (TLIF) Posterolateral fusion
	Stenosis	Lamino-foraminotomy
	Tumors	Resection (with or without fusion)
	Pseudoarthrosis	Revision fusion



degenerative spin



Degenerative Cervical Spine Disorders

The cervical spine is the most flexible anatomic region in the axial skeleton. Distinct segments of the cervical spine give us the ability to perform complex neck motions like head turning or tilting and to carry weight or absorb impact while protecting the delicate spinal cord and nerve roots that pass through the cervical vertebra. Vital supportive structures of the cervical spine, such as the discs, facet joints, and surrounding ligaments, are subject to repetitive injury and degeneration from normal activities, such as work or sports, and from aging, stress, or trauma.

The Occipito-Cervical Junction

Instability in the atlanto-occipital joint results in hyper-mobility of the junction between the head and the neck, which can cause severe pain or paralysis. It may result from rheumatoid arthritis or congenital defects that can accelerate degenerative arthropathy, resulting in basilar invagination. The UCSF Spine Center uses the latest developments in imaging, computer-assisted surgery, and instrumentation to provide safer and more effective decompression and arthrodesis.

The Atlanto-Axial (C1-2) Joint

Chronic C1-2 instability and subsequent joint degeneration is primarily caused by trauma, congenital odontoid

insufficiency, or rheumatoid arthritis. UCSF spine surgeons have substantial experience with complex surgical procedures, including use of either transarticular screws or pedicle screws to restore stability to this segment without injuring the vertebral arteries.

Subaxial Cervical Spine

The most common degenerative disorders of the cervical spine affect the sub-axial C3-C7 segments. Symptoms of disc herniation, joint degeneration, and spondylosclerosis include radicular pain and sensorimotor deficit or myelopathy with spasticity and pathological reflexes. At UCSF, minimally invasive approaches can be performed posteriorly

symptoms associated with cervical spine disorders

Symptom	Cause
Neck pain and headache, radiating to the shoulders, arms, and hands	Radiculopathy due to disc herniation and spondylosclerosis
Diminished dexterity Spastic gait Neurogenic bladder dysfunction	Myelopathy caused by spinal cord compression from neural canal stenosis
Neck pain during movement and head flexion	Segmental instability caused by degenerative spondylolisthesis, kyphosis, or post-traumatic deformity

e disorders

thoracolumbar conditions treated include:

- Disc herniations
- Stenosis
- Adult scoliosis
- Kyphosis
- Spondylolisthesis

for decompression of nerve roots. Our surgical team also has expertise in motion-sparing operations such as cervical disc replacement and cervical laminoplasty that obviate the need for a cervical spinal fusion. As a tertiary care spine center, we have substantial experience in treating complex cervical spine problems with osteotomies, corpectomies, reconstruction, and multilevel fusion with instrumentation.

Degenerative Thoracolumbar Spine Disorders

Degenerative thoracolumbar disorders are becoming increasingly prevalent as patients have longer, healthier, and more active lives. While

much of the treatment is non-surgical, there are certain conditions that require surgery. Some degenerative diseases can be easily treated with small, minimally invasive procedures, but others require large, reconstructive operations. The spine surgeons at UCSF have considerable experience treating the entire spectrum of degenerative disorders, as well as in-depth knowledge of the success rates of each procedure. This experience enables them to guide patients towards the appropriate treatment based on the entire clinical picture, not just a focal finding.



Left) Preoperative lateral x-ray film demonstrating L5/S1 spondylolisthesis with spondylolisthesis and foraminal stenosis. Right) Postoperative lateral x-ray film following ALIF with anterior cage and plate and minimally invasive posterior decompression and pedicle screw fixation.

spinal tumors



The UCSF Spine Center offers treatment for all primary and metastatic tumors from the skull base to the sacrum. We treat a high volume of spinal tumor cases each year and our spine surgeons are continually at the forefront of developing new techniques for optimal resection of the most difficult tumors.

The Spine Center faculty who specialize in tumors are members of the Spine Oncology Study Group — an international collaboration of spine tumor experts who partner in studying the behavioral pattern of these tumors and analyzing the efficacy of current therapies.

Our surgical team has special expertise in transpedicular corpectomy and en bloc resection, sparing many cancer patients from a thoracotomy procedure and resulting in less morbidity and shorter hospital stays.

All spine tumor cases are routinely reviewed at a multidisciplinary spine tumor board to determine the best treatment options for each patient. The close collaboration between neurosurgeons, orthopaedic surgeons, radiation oncologists, and oncologists at the UCSF Helen Diller Family

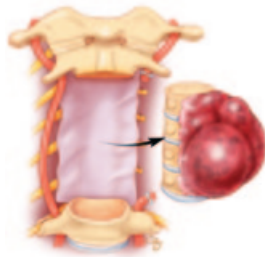
Comprehensive Cancer Center offers patients the benefit of care from a variety of specialists.

The UCSF Spine Center is one of few programs to offer the latest CyberKnife VSI™ radiosurgery platform for the treatment of spinal tumors. This non-invasive, painless treatment can be done in one to five sessions and can be used to treat primary and metastatic tumors definitively or as a supplement to surgery. The CyberKnife can also be used to treat patients who have inoperable tumors or who were previously irradiated.

Advantages of CyberKnife VSI™ Radiosurgery for Spinal Tumors:

- Robotics and advanced image-guidance adjust for a patient's movements and map the precise location of the lesion during treatment.
- Focused radiation delivers a maximally aggressive dose of radiation to the target abnormality with minimal impact on the healthy tissue.
- No frame is used to immobilize the patient.

- Treatment is completed on outpatient basis without the need for a hospital stay.
- The VSI™ System is the latest development in CyberKnife technology. Faster radiation delivery and variable beam apertures enable us to considerably reduce the treatment time, extending the advantages of radiosurgery over conventionally fractionated radiation therapy.



Top) 3-Dimensional CT reconstruction of a sacral tumor.

Bottom) En bloc resection removes the tumor in one piece using wide margins to avoid violating the tumor and reduce local spread of malignant cells.



surgical techniques for removal of malignant neoplasms

- Spondylectomy (en bloc resection) for primary and metastatic tumors, including sacral tumors
- Transpedicular corpectomy for metastatic tumors
- Cervical transpedicular technique for ventral intradural tumors
- Lateral transpedicular approach to deep midline tumors of the cervical spine
- Image-guided tumor resection using advanced neuronavigation software

The CyberKnife radiosurgery platform at UCSF Medical Center provides non-invasive treatment for spinal tumors.

vertebral compression

Older patients and those with osteoporosis have a high risk of spinal fractures, particularly vertebral compression fractures. The reasons are multi-factorial but include low bone mass and strength, as well as an increased risk of falling. In these patients,

vertebral compression fractures can occur during simple activities of daily living, such as coughing, sitting down quickly, or taking a step wrong. Vertebral fractures in younger patients typically result from substantial trauma.



Vertebral fractures occur with twice the frequency of hip and wrist fractures combined. Approximately 700,000 vertebral compression fractures are diagnosed in the United States annually. As with many fragility fractures, vertebral compression

fractures are more common in women than men; however, the consequences are severe in both. Patients may experience acute and chronic pain, kyphotic deformity (increased forward curve of the spine), compromised respiratory and GI function, increased risk of

future fractures, decreased quality of life, increased anxiety, depression, and death.

The UCSF Spine Center provides care from specialists in spine surgery, radiology, internal medicine, gerontology, endocrinology, physical therapy, orthotics

and prosthetics, pain management, and skeletal health. Comprehensive and integrated care is essential to minimize the severe morbidity and mortality associated with vertebral compression fractures, as well as prevent future fractures.

high-risk spine surgery team

A high-risk spine team has been formed at UCSF to improve surgical care for elderly patients (> 65 years) with spinal conditions, who are at higher risk of complication during surgery. Each patient is treated by a hospitalist and a nutritionist who optimizes the

patient's diet prior to surgery. A neurosurgeon and an orthopaedic surgeon operate on each patient simultaneously with the goals of decreasing blood loss and shortening operating times.

Orthopaedic surgeon Vedat Deviren and neurosurgeon Christopher Ames collaborate in the operating room to perform a spinal fusion for a high-risk patient.

Compression fractures



Indicators of possible vertebral compression fractures in older patients

- Development of back pain
- Stoopd or hunched posture
- Loss of 0.5 inch or more in height in one year
- Loss of more than 1.5 inches from original height
- Protuberant abdomen
- Decreased respiratory capacity
- Early satiety, weight loss

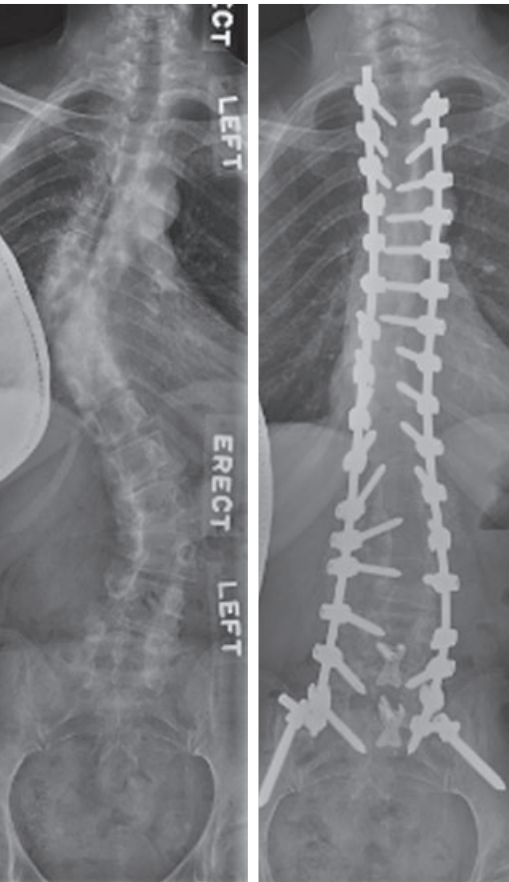
In Patient Management	Out Patient Management
Medical management of co-existing conditions	Spine Clinic
Imaging (Xray, CT, MRI)	Imaging (Xray, CT, MRI)
Surgical Care <ul style="list-style-type: none"> • Percutaneous vertebral augmentation • Decompression and fusion 	Surgical Care <ul style="list-style-type: none"> • Percutaneous vertebral augmentation
Non-surgical Management <ul style="list-style-type: none"> • Pain management • Physiatry • Short-term bracing, if indicated 	Non-surgical Management <ul style="list-style-type: none"> • Pain management • Physiatry • Orthotics, if bracing is indicated
Physical Therapy for safe mobility, fall prevention, and discharge planning	Physical Therapy for safe mobility and fall prevention
Skeletal Health <ul style="list-style-type: none"> • Evaluation (risk-factor screening, labs) • Optimization of nutrients • Patient education 	Skeletal Health <ul style="list-style-type: none"> • Evaluation (risk-factor screening, dual x-ray absorptiometry, labs) • Treatment of osteopenia/osteoporosis • Patient education • Stand Tall exercise program for osteoporotic patients

deformity



The UCSF Spine Center provides expert care for all aspects of spinal deformity, including kyphosis, scoliosis, and

spondylolisthesis, which may result in acute or chronic instability, neurological deficit, and pain.



Our spine surgeons place particular emphasis on adequate and thorough neural decompression and protection, combined with restoration of normal global and regional spinal balance. State-of-the-art spinal cord monitoring techniques are employed by PhD-level electrophysiologists in the operating rooms to provide the highest levels of patient safety.

Conditions treated include:

- Adult degenerative scoliosis
- Adult idiopathic scoliosis
- Adolescent scoliosis

- Congenital deformities
- Scheuermann's kyphosis
- Severe lordotic deformities
- Severe kyphotic deformities
- Failed-back syndrome
- Flat-back syndrome
- Chin-on-chest kyphotic deformity
- High-grade spondylolisthesis
- Neuromuscular scoliosis
- Ankylosing spondylitis
- Rheumatoid arthritis

To restore functional capacity and eliminate pain, our skilled team uses a wide variety of techniques, including pedicle subtraction osteotomies,

Smith-Petersen osteotomies, Ponte-type osteotomies, and vertebral column resection.

spinal deformity in patients with parkinson's disease

Movement disorders and spine care specialists at UCSF work together closely to care for patients with both Parkinson's disease and spinal deformity. Although there is little guidance for management, this issue is becoming increasingly relevant with a growing elderly population of Parkinson's patients.

Spinal deformity can be a consequence of Parkinson's disease, and a recent study at UCSF demonstrated a 50% complication rate for operations on these patients. Adjacent segment degeneration and junctional kyphosis are common in Parkinson's patients, and these patients often require multiple surgeries to treat spinal deformity.

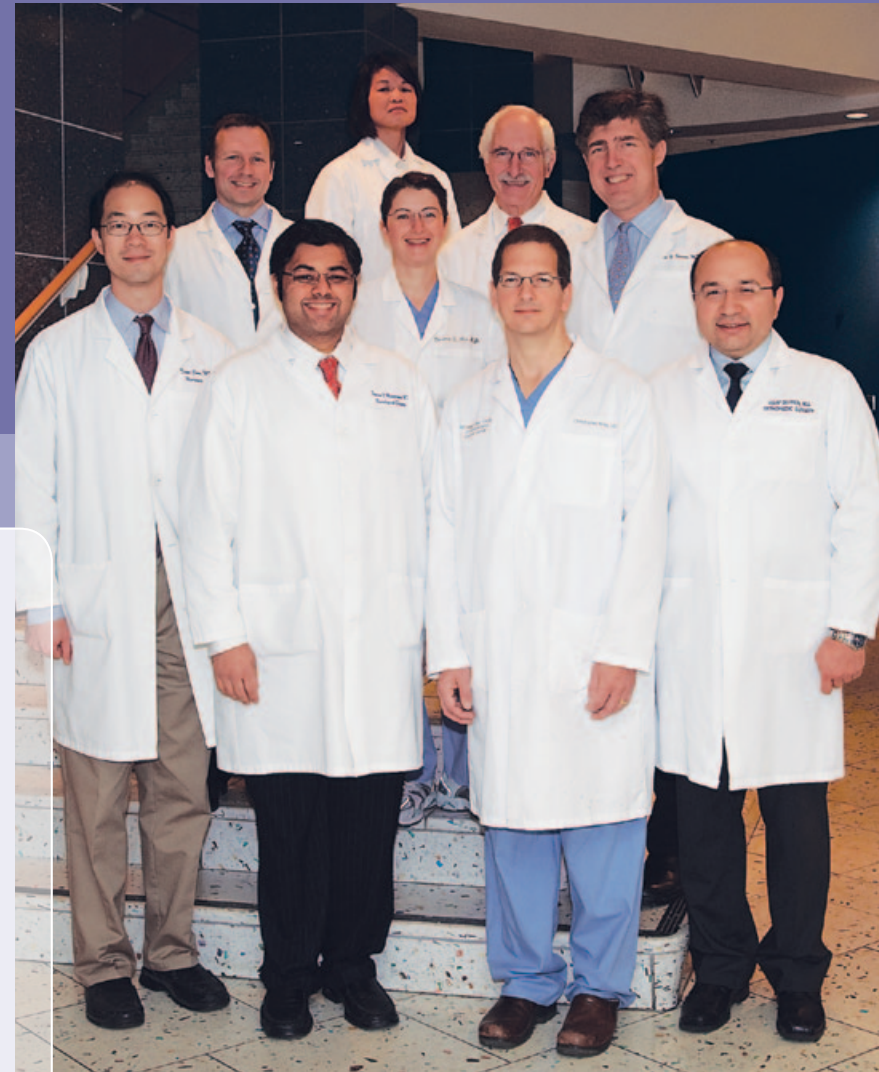
A 60-year-old female patient with severe back pain caused by scoliosis was successfully treated by spine surgeons at UCSF. **Left:** Before the operation, x-ray images revealed severe deformity of the spine. **Right:** Six months after surgery, the spine's normal curvature has been restored and the patient is now free of her back pain.

clinical research

All the faculty and staff in the UCSF Spine Center are dedicated to improving our care of spine patients. Performing clinical research allows us to improve care in a way that reaches people with spinal conditions worldwide.

By systematically and analytically reviewing our patients' outcomes, we can implement the best evidence-based practices. Many of our patients are involved in specific ongoing studies, and all patients are

asked to complete outcomes questionnaires so that we may objectively and carefully evaluate the effectiveness of our recommendations and surgeries.



current areas of study

- Incidence and risk factors for degeneration and disease adjacent to a fusion
- Risk factors for developing kyphosis at the end of a fusion
- Use of teriparatide (parathyroid hormone) to potentially increase the healing rate of spine fusions
- Specialized MRI sequences to determine which discs may be painful
- Evaluating the risk factors for complications of surgery, such as infection, DVT/PE, or reoperation
- Improved nerve monitoring techniques for placement of pedicle screws
- Defining the coexistence of cervical spondylosis and adult spinal deformity

0320
University of California, San Francisco
UCSF Box 0112
San Francisco, CA 94143-0112

ADDRESS SERVICE REQUESTED

Nonprofit Org.
U.S. Postage
PAID
University of
California
San Francisco

UCSF

University of California
San Francisco

advancing health worldwide™

ucsf spine center

To refer a patient to the UCSF Spine Center,
call (866) 81-SPINE or (866) 817-7463.

UCSF Spine Center
400 Parnassus Ave., Third Floor
San Francisco, CA 94143-0332
Fax: (415) 353-4047

Visit us online at neurosurgery.ucsf.edu
and orthosurg.ucsf.edu

UCSF Medical Center
Spine Center

