Spinal Disorders in the Aging Population

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During the next 25 years, the number of people in the U.S. older than 65 years will increase by 125%, to approximately 70 million.

The primary goals of spinal surgery in the aging population is to restore mobility and decrease pain.
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- Outcomes from spinal surgery on the older patient is related to the patients co-morbidities.
- Age by itself does not affect the outcome.
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- Degenerative spine disease refers to any disease of the spinal column that results from the aging process.
- The degenerative process starts with the intervertebral disc.
- As part of the aging process, the intervertebral disc desiccates and the discs lose their flexibility, elasticity and shock absorbing capacities.
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- Because the degenerated disc is no longer able to bear as much of the mechanical load, the facet joints take on the extra load.
- The increased load on the facet joints causes the healthy cartilage to degenerate which exposes the underlying bone.
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- An inflammatory reaction ensues, causing facet joint and ligamentum flavum hypertrophy.
- The hypertrophy of the facet and ligament narrow the central canal, lateral recess and exit foramen of the spine causing spinal stenosis.
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- Lumbar spinal stenosis is the most common reason for lumbar surgery in adults over the age of 65.
- Patients typically present with neurogenic claudication – pain or numbness in the buttocks and/or legs with walking that resolves with sitting or lumbar flexion.
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- Patients with neuroforaminal stenosis typically present with radicular pain with standing that is relieved with lumbar flexion or sitting.
The treatment of spinal stenosis includes:

- NSAIDS, Gabapentin or Lyrica, Opiates
- Physical Therapy, Lumbar Traction
- Epidural Steroid Injections
- Surgery
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- The Spine Patient Outcomes Research Trial (SPORT) studied randomized and observational cohorts of patients with a history of at least 12 weeks of symptoms and spinal stenosis without spondylolisthesis at 13 U.S. spine clinics.
- The primary outcomes measured pain and physical function at 6 weeks, 3 months, 6 months and 2 years.
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- The SPORT study concluded that in patients with imaging-confirmed spinal stenosis without spondylolisthesis and leg symptoms persisting for greater than 12 weeks, surgery was significantly superior to nonsurgical treatment in relieving pain and improving function.
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- The surgery performed in the SPORT study was an open lumbar decompression.
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- Lumbar decompressions may also be performed minimally invasively with good results.
An additional surgical option for patients who symptoms are relieved with lumbar flexion is the placement of an interspinous distraction device.
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- Years of chronic disc degeneration and progressive facet degeneration leads to incompetence of the facets resulting in segmental instability and slippage – degenerative spondylolisthesis.
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- Patients with degenerative spondylolisthesis present with back pain from the segmental instability, neurogenic claudication from associated spinal stenosis and radicular pain from neuroforaminal stenosis.
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- Approximately 22% of men and 30% of women over the age of 65 have degenerative spondylolisthesis.

- Treatment options include:
  - Medical management including limitation of activities
  - PT
  - ESI
  - Surgery
The Spine Outcomes Research Trial (SPORT) also studied randomized and observational cohorts of patients with symptoms of at least twelve weeks duration and imaging demonstrating degenerative spondylolisthesis with stenosis.

Treatment consisted of a standard decompressive laminectomy (with or without fusion) or usual nonoperative care.

Patients treated surgically maintained substantially greater pain relief and improvement in function over the four year follow-up.
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- Morbidity from surgery for degenerative spondylolisthesis in the SPORT study was low.
- Dural tear was the most common complication occurring in 11% of the surgeries.
If surgical intervention is opted for in the treatment of degenerative spondylolisthesis with stenosis in patients who have back pain in addition to buttock or leg or symptoms, a central decompression is commonly augmented by posterolateral fusion with an interbody graft.
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- Herkowitz performed a prospective randomized study on patients with degenerative spondylolisthesis with an average three-year follow-up.

- 96% of fused patients had good to excellent results in comparison with only 44% of patients who underwent decompression without a fusion.
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- However, a recent study in *JAMA* indicates that the results of complex fusions (More than 2 disc levels or combined anterior and posterior approach) performed for lumbar stenosis are problematic.

They found that the rates of decompressive surgery and simple fusions (1 or 2 disc levels, single surgical approach) declined during this time period.
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- “However, rates of complex fusion surgery increased from 1.3 per 100,000 to 19.9 per 100,000, 15-fold increase. Correspondingly, although the overall procedure rate fell 1.4 percent, aggregate hospital charges increased 40 percent (inflation adjusted).”

- Patients who underwent a complex fusion procedure had a 3-times higher odds for a life-threatening complication compared with decompression alone.
According to the authors, it is unclear why the number of complex operations for spinal stenosis are increasing.

However, it seems implausible that the number of patients with the most complex spinal pathology increased 15-fold in just 6 years.
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- Cervical spondylosis is a common degenerative condition of the cervical spine.
- As with lumbar spondylosis cervical spondylosis starts with degeneration of the intervertebral disc.
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- The intervertebral discs are composed of a nucleus pulposus and an annulus fibrosus.
- The nucleus pulposus contains a hydrated gel-like matter that resists compression.
- The annulus fibrosis is a strong radial tire-like structure made up of lamellae; concentric sheets of collagen fibers connected to the vertebral end plates.
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- As discs age, they fragment, lose water and collapse. Initially this starts in the nucleus pulposus.
- Degeneration of the nucleus pulposus causes the external concentric bands of the annulus fibrosus to bulge outward causing increased mechanical stress at the cartilagenous endplates of the vertebral body.
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- Subperiosteal bone formation occurs next, forming osteophytic bars that extend along the ventral aspect of the spinal canal causing spinal stenosis.
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- In addition, hypertrophy of the uncinate process occurs, often encroaching on the neuroforamen causing a radiculopathy.
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- When cervical stenosis compresses the spinal cord, cervical myelopathy results.
- Degenerative kyphosis and subluxation are fairly common findings associated with cervical spondylosis and may further contribute to spinal cord compression.
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- Cervical flexion and extension may aggravate spinal cord damage. During flexion, the spinal cord lengthens, resulting in it being stretched over the osteophytic bars. During extension, the ligamentum flavum may buckle into the cord, pinching the cord between the ligaments and the anterior osteophytes.
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- Symptoms of cervical myelopathy include:
  - Heavy feeling in the legs
  - Inability to walk at a brisk pace
  - Deterioration in fine motor skills (such as handwriting or buttoning a shirt)
  - Intermittent electric shock down the spine with neck flexion (Lehrmitte’s sign)
  - Arm pain (radiculopathy)
  - Urinary frequency or hesitancy, incontinence is rare
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- Myelopathy affects the nerve tracts that run inside the spinal cord (long tracts) and deficits in these long tracts can be picked up on physical exam:
  - Leg spasticity
  - Hyperreflexia
  - Ankle clonus
  - Loss of vibratory sense and proprioception in the feet
  - Positive Babinski reflex
  - Hoffman’s sign
  - Decreased fine motor coordination in the hands
  - Inability to heel-toe walk
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- The only effective treatment for cervical stenosis with myelopathy is surgery.
- Pathologic series of cervical spodylotic myelopathy demonstrate that long periods of severe stenosis over may years are associated with demyelination of white matter and necrosis of both gray and white matter of the spinal cord leading to an irreversible deficit.
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- Surgical decompression can be performed through an anterior or posterior approach or both.
- The choice of the surgical approach involves a number of factors. Briefly, a posterior approach is preferred if the cervical stenosis involves 3 or more disc spaces as long as the patient has a preserved cervical lordosis.
- Cervical laminectomy in the setting of cervical kyphosis can lead to a swan neck deformity.
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- In conclusion, the older patient comprises an increasing proportion of the spine surgeon’s practice.
- The most challenging task remains patient selection.
- Balancing benefits, risks, complications and the durability of various interventions in the older patient population is difficult because of the limited number of prospective outcome studies.
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- Optimally, further research will lead to the creation of evidence-based management protocols.
- Ideally, these protocols would make the treatment of spinal disorders in the aging population not only more effective but less expensive.
- Demographic changes will make management of spinal disorders in the aging population a major focus of the neurosurgical community for the next 25 years.
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THANK YOU!