

# OKLAHOMA SPINE & BRAIN INSTITUTE

*Dedication. Compassion. Innovation*

- September 2015 Update -



*Michael Thambuswamy, M.D.*

## Oklahoma Spine & Brain Institute is Proud to Introduce Michael Thambuswamy, MD, MBA

Michael Thambuswamy, M.D., is from the Tulsa area where he graduated, with honors, from Jenks High School. He completed his neurosurgery training as Chief Resident at the highly acclaimed Miller School of Medicine at the University of Miami. Prior to attending the University of Miami Dr. Thambuswamy completed his doctorate degree from the University of Oklahoma College of Medicine. Beginning with his undergraduate education at Baylor University in 1997, Dr. Thambuswamy has been a very active member of student life, holding elected positions in several student organizations and student government. He also graduated with his M.B.A. from Baylor University in 2002 with an emphasis in finance and accounting. He returned to medicine after receiving a performance award for his work with the Gatorade/Pepsi campaign during his time with a successful marketing firm in Dallas, TX. Throughout his medical school career he has been a devoted member of the community, having provided continuity of healthcare to the underserved “working poor” population of Tulsa, OK, at Bedlam Longitudinal Clinic; volunteering evenings at Bedlam Clinic, a student-run and student-directed free clinic for the uninsured and underserved, and volunteering also at Oklahoma elementary schools to promote an interest in the sciences and teaching about career opportunities in scientific fields.

## Osteoporosis and Diagnosis and Treatment of Vertebral Compression Fractures Written by Frank J. Tomecek, M.D.

In today’s aging population worldwide, osteoporosis becomes an ever-increasing presence and affects 100 million people worldwide. There are 44 million people in the United States, more than 1/7 of our population, that have osteoporosis. Many of these patients are not diagnosed. Over 2 million fragility fractures occur in the United States per year with 547,000, or about 26%, of the fragility fractures that are osteoporotic vertebral compression fractures mostly of the thoracic or lumbar spine. Other common sites for fragility fractures are of the hip and of the wrist. Osteoporosis is a major public health threat in this country. One in two women and one in four men over the age of 50 will experience osteoporotic fractures of the long bones or spine. Vertebral compression fractures increase in incidence with patient age, and we are part of an ever-aging population. Interestingly, only 1/3 of spinal fractures come to clinical attention, and underdiagnosis is a worldwide problem. There are 150,000 people hospitalized in this country annually due to pain and medical management of spinal fractures.



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Osteoporotic spinal fractures should be considered in any patient with back pain following minimal trauma who is over the age of 55. These fractures can occur from day-to-day activities, such as bending forward, lifting objects, climbing stairs, and very minor falls, such as on a wet floor in the bathroom. When assessing a patient with a diagnosis of a vertebral compression fracture, one must always consider underlying causes, such as metastatic cancer to the bone. Common risk factors for spinal fracture include age, low bone mineral density and osteoporosis, steroid use causing secondary osteoporosis, smoking, early menopause, malnutrition that can sometimes be caused by gastric bypass or unintentional weight loss, high alcohol use, and a sedentary lifestyle. There is an increased risk of fragility fractures in men with low testosterone levels and, as mentioned, in smokers, because nicotine is toxic to osteoblasts, which form bone.

Spinal fractures have a high impact on a patient's overall general health. They lead to chronic, debilitating pain. Patients develop a kyphotic posture and deformity, which can cause decreased pulmonary capacity and lung function. Decreased pulmonary capacity can affect physical function. Deformity can cause impaired gait or poor balance. Kyphotic deformity can cause early satiety and gastric distress. Kyphotic deformities and pain can develop into sleep disorders and decreased activities of daily living. Also, kyphotic deformity and compression fractures can change the biomechanics of the spine and increase one's future fracture risk and overall increased mortality. Women with vertebral fractures have a five-fold increased risk of a new vertebral fracture and a two-fold increased risk of a hip fracture. An increased risk for subsequent fracture after an initial compression fracture of the spine persists for up to ten years. Women with one or

more prevalent vertebral compression fractures have a 23% higher age-adjusted mortality rate, and the most common cause of death is pulmonary disease and failure related to the degree of kyphosis in the thoracic spine. In diagnosing and treating fragility fractures, the physician must not forget that men are highly affected by these conditions as well, as 1/3 of men with a fragility fracture of the hip die within a year. In addition, men with a fragility fracture have even higher risks than a woman of a subsequent fracture.

Diagnosis of a vertebral compression fracture is both clinical and supported by radiographic diagnostic testing. The most common symptom is severe, acute onset pain after minimal trauma. Plain x-ray can identify the majority of vertebral compression fractures. The weakness of a plain x-ray is that it cannot differentiate usually between an acute and chronic fracture. To differentiate between an acute and chronic fracture and to determine if treatment is necessary, it is helpful to obtain an MRI that shows hyperintense changes in the bone on T2-weighted imaging and hypointense changes in the bone on T1-weighted imaging. Also, a bone scan of the whole body shows increased uptake in an acute or subacute vertebral compression fracture. These x-ray tests, however, do not differentiate between causes of vertebral compression fractures, which in the differential diagnosis one must always remember not only osteoporosis causes these fractures, but also secondary osteoporosis due to malignant tumor invasion, or infections can cause osteomyelitis, which can weaken the vertebrae and lead to a fracture as well.

Treatment options for vertebral compression fractures include bed rest for severe pain; however, prolonged pain and bed rest can lead to loss of function and possible loss of patient's independence and other morbidities, such as DVT and pneumonia. Other treatment options include analgesics and opioids. Physical therapy is usually not helpful for a compression fracture. Lumbar or thoracic bracing can be helpful in the short-term and acute fractures. Steroid injections are usually not helpful for compression fractures unless they are associated with radiculopathy. Minimally invasive treatments include vertebroplasty, balloon kyphoplasty, or a newer technique, which is FDA-approved and has been studied in randomized Level I clinical testing called Kiva kyphoplasty.

The short-comings of nonsurgical management, such as bed rest, medications, or back braces, include a failure to relieve a patient's pain, the potential to exacerbate further bone loss with inactivity and lack of mobility, and these nonsurgical treatments may not provide long-term functional improvement in the patient. In addition, bed rest and bracing does not attempt to restore the normal vertebral anatomy, posture, and alignment of the spine.

The doctors at the Oklahoma Spine & Brain Institute are also very aware that in addition to simply treating the vertebral compression fracture and the symptoms related to it, we must also be mindful of the patient's overall medical condition and bone health, and all factors that could contribute to osteoporosis must be treated accordingly to prevent the high risk of recurrent fractures. We use the FRAX System to estimate an individual's fracture risk. FRAX is a computer-based algorithm that uses easily obtained clinical factors to estimate an individual's ten-year fracture probability. This FRAX algorithm comes in an app, which can be used from a handheld device, such as a smartphone, to calculate and identify patients at high risk for fracture. The FRAX calculation tool is used by the World Health Organization, and it is composed of a questionnaire with 12 questions that assess age, sex, weight, height, previous fracture history, family history, history of smoking, history of steroid use, history of rheumatoid arthritis, presence of secondary osteoporosis, assessment of alcoholic intake, and inclusion of femoral neck bone mineral density assessed with a DEXA scan. When the answers to all of these questions are loaded into the app, a percent risk of fracture over the next ten years is calculated. Patients with high risk of fracture who have osteoporosis or severe osteopenia are recommended to have subsequent medical management for these diagnoses. First, patients with osteoporosis are tested with further lab tests to rule out secondary causes of bone loss. We at the Oklahoma Spine & Brain Institute frequently order a CBC with diff, serum calcium and protein levels, 24-hour urinary calcium excretion, and vitamin D levels. A very common cause of poor bone metabolism in our country involves inadequate calcium and vitamin D levels. The National Osteoporosis Foundation recommends for women with an age over 50 and men with an age over

55 that we maintain an adequate calcium and vitamin D level. It is also recommended that weightbearing and muscle strengthening exercises are performed regularly. It is also highly recommended to avoid smoking and excessive alcohol use, and treatment after appropriate evaluation and exclusion of secondary causes of osteoporosis are also recommended. In addition, it is highly recommended to prevent falls, and to do so, the National Osteoporosis Foundation recommends vision and hearing checks, neurologic evaluations, review of prescription medication for side effects that affect balance, and approved safety strategies at home. Vitamin D is essential for bone metabolism, because it stimulates intestinal calcium and phosphorous absorption. It stimulates bone mineralization. Vitamin D levels don't reach 100% capacity unless they are over 40. However, vitamin D levels are not considered low unless they are below 30. It should be mentioned that every 1,000 units of vitamin D that are administered to a patient will raise the serum vitamin D level by 7.

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For patients who are diagnosed with osteoporosis, and especially those that have previous vertebral compression fractures, it is commonly recommended that in addition to maximizing bone metabolism with appropriate vitamin D levels and calcium, further medical treatments are felt to be necessary to improve bone density. The Oklahoma Spine & Brain Institute recognizes Forteo, which is human parathyroid hormone, as the only medication that has anabolic effects, which increase skeletal mass and increase bone strength. Human parathyroid hormone stimulates new trabecular and cortical bone formation and has a

preferential stimulation of osteoblasts over osteoclasts, which increases skeletal mass. Forteo is the only medication with anabolic effects on both osteoblasts, which produce bone, and osteoclasts, which remove bone and remodel bone. It has been recognized in studies to actually be the only medication to promote and enhance bone healing in fractures and in spinal fusion surgeries.

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The physicians at Oklahoma Spine & Brain Institute are fully aware that in this country, patients with osteoporosis who have sustained a minimal traumatic fracture or compression fracture of the vertebrae are not routinely receiving appropriate care to prevent future fractures. In a recent retrospective study, approximately four out of five patients (78%) with a history of hip or wrist fracture did not fill a prescription for the treatment of osteoporosis in the six months after their fracture was diagnosed. Therefore, a significant treatment gap exists for patients with osteoporosis who have sustained a fragility fracture. It is estimated that by the year 2030 that nearly 20% of our population will be over the age of 65 and, therefore, osteoporotic fractures are certainly going to continue to be an ever-increasing problem. The physicians at the Oklahoma Spine & Brain Institute recognize that patients with fragility fractures need a more proactive approach to treating osteoporosis. Patients age 50 and older with a hip or vertebral fracture and a bone mineral density T-score less than -2.5 at the femoral neck or spine, according to the National Osteoporosis Foundation treatment guidelines, should receive further medical management for osteoporosis beyond just maximizing vitamin D and calcium levels. We

recognize Forteo as the only FDA-approved anabolic agent to help form new bone and increase both cortical and trabecular bone volume and connectivity. Forteo has been shown to increase lumbar spine bone mineral density in women and men with osteoporosis and significantly decrease the risk of new vertebral fractures by nearly 65%. Forteo is provided as a 20 mcg prefilled fixed-dose subQ injectable device and is administered once a day. It has been shown that appropriate use of Forteo can prevent adjacent level fragility fractures to thoracic and lumbar fusions and previously treated patients with kyphoplasty for vertebral compression fractures. Forteo can also be used post-operatively to promote spinal fusion in osteoporotic patients. In addition to Forteo, there are numerous other medications on the market to increase bone mass and strength. Prolia, for example, is human IgG2 monoclonal antibody that binds to a cellular transmembrane protein that is essential for the formation, function, and survival of osteoclasts, which increase bone resorption. Prolia inhibits osteoclasts and, therefore, decreases bone resorption and increases bone mass and strength. In addition to Prolia, there are a number of bisphosphonates (e.g., Actonel 35 mg by mouth q.week, Boniva 150 mg by mouth q.month, Fosamax 70 mg by mouth q.week, and Reclast 5 mg IV q.12months), which inhibit digestion of bone by encouraging osteoclasts to undergo apoptosis and thereby slowing bone loss. The problems with Prolia and bisphosphonates, however, are that they are not anabolic medications and are not felt to be the best treatment for patients with acute or subacute fractures or who have had recent spinal fusion. These medications suppress bone turnover and remodeling and can lead to delayed fracture healing and delayed fusion. Therefore, in patients who have had a recent spinal fracture or spinal fusion, Forteo is recommended for patients who have a concomitant diagnosis of osteoporosis.

Recent prospective studies in the spinal literature, namely FREE and KAST, have shown improvement in back pain and in overall patient function in patients with kyphoplasty procedures. More recently, the KAST study assessing the Kiva System, which has been FDA-approved within the last year, shows not only improvement in pain and function in patients with spinal fractures after kyphoplasty treatment,

but also a reduced rate of adjacent level fractures, as compared to balloon kyphoplasty and a reduced rate of extravasation of methyl methacrylate out of the vertebral body or into the spinal canal. Kyphoplasties involve a percutaneous needle technique administered through the spinal pedicle and into the fractured bone and involve either implantation of a PEEK system, as in Kiva, or in placement of a balloon into the vertebrae, which is inflated to create a void, and then methyl methacrylate is injected into the void in the vertebral body. The Kiva System involves injection of the methyl methacrylate within the PEEK implant, which prevents extravasation of the cement into unwanted places, such as the spinal canal or out of the vertebrae and into the vascular system. The Kiva System has also been recently published to show overall improvement in the level of pain superior to balloon kyphoplasty and the amount of methyl methacrylate used was much less with the Kiva System, decreasing any potential side effects from the cement. For subacute or acute compression fractures in prospective studies, patients in both the Kiva and balloon kyphoplasty groups show substantial improvements over controls. Most patients treated with kyphoplasty, as early as two weeks after the onset of their back pain show marked improvement by seven days post minimally invasive treatment.

In summary, osteoporosis is an ever-increasing threat to our patients' medical health. Vertebral fractures are the most common osteoporotic fractures. Patients with a vertebral fracture have an increased risk of subsequent vertebral fractures by five-fold and an increased risk of other fragility fractures by two to four-fold. We at the Oklahoma Spine & Brain Institute are acutely aware of the fact that patients with osteoporosis and patients with vertebral fractures are severely underdiagnosed and undertreated. We are fully trained and educated on the most up-to-date medical and minimally invasive surgical treatments for patients with vertebral compression fractures and fragility fractures. For further information and with any questions regarding osteoporosis and vertebral compression fractures, please feel free to contact us here at the Oklahoma Spine & Brain Institute.

*Oklahoma Spine & Brain Institute is a speciality private practice group, dedicated to delivering the highest quality neurosurgical care possible. Our doctors are some of the best neurosurgeons in the country and our staff is focused on providing our clients the best possible experience.*

*We value the opportunity to provide you with care, and have multiple locations in place to make patient visits as convenient as possible.*