

CLINICAL CASE OF PULMONARY CEMENT EMBOLISM AND ADJACENT FRACTURES AS A COMPLICATION AFTER VERTEBROPLASTY

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Abstract. Osteoporosis is a skeleton disease with reduction in bone mass and disruption of the bone microstructure. A rare secondary form is pregnancy-associated osteoporosis. The standard method for determining bone density is DEXA measurement (dual X-ray absorptiometry). With the radiofrequency echographic multi spectrometry (REMS) method this is done using ultrasound without radiation exposure. Osteoporosis often leads to pathological fractures of the vertebrae. In case of severe pain and immobilization vertebroplasty is considered standard procedure. However, it can have side effects such as cement leakage into surrounding tissue, pulmonary embolism and adjacent fractures. We present a 27-year-old female patient with compression fractures of the Th8 and Th12 5 months after labor. DEXA measurements showed values of the T-score at hip neck -2.5 SD (total) and -3.5 SD (L1-L4) at spine. The fractures of the Th8 and Th12 were then treated with vertebroplasty. A post-operative CT showed cement leakage and extravasation, as well as bilateral cement embolism of the proximal branches of the pulmonary arteries and progression of the height loss of Th5, Th7 and L1. Pulmonary cement embolism is a rare complication of vertebroplasty. Cement leakage is more frequent complication, although most of the time asymptomatic. These risks of complications make the alternative conservative treatment worth considering before proceeding to surgical interventions. Only after failure to achieve adequate pain management kyphoplasty or vertebroplasty should be considered, due to the risks of prolonged immobilization of the patient leading to further bone and muscle loss. Pregnancy associated osteoporosis is very rare. The radiation free REMS method is suitable for pregnant women. Vertebroplasty offers pain relief and rapid mobilization of the patient. However, it poses a risk of numerous complications. The osteoporotic fractures of the vertebrae are usually stable and a conservative treatment prior to surgical interventions should always be considered.

Key words: pregnancy associated osteoporosis, compression fracture, vertebroplasty, complications, cement pulmonary embolism

INTRODUCTION

Osteoporosis is a systemic disease of the skeleton with a reduction in bone mass and the resulting disruption of the microstructure of the bone [1]. It is becoming increasingly important in the current aging population. For this reason, the WHO included osteoporosis in the list of the 10 most important diseases worldwide.

In addition to the classic primary osteoporosis, in which there is a loss of bone mass due to the reduction in movement and the general reduction in muscle mass, there is secondary osteoporosis. Secondary osteoporosis can have many different causes, e.g. metabolic, neoplastic or hormonal.

A rare disease is pregnancy-associated osteoporosis (PAO). With a prevalence of 0.4/100,000 women, it is one of the very rare type of secondary

osteoporosis [2]. Due to the rarity, a high number of unreported cases can be assumed. Only about 120 cases have been reported in the literature [4]. The disease usually occurs in the 3rd trimester of pregnancy or during the subsequent lactation period, which is why it is also referred to as pregnancy and lactation-associated osteoporosis (PLO) [2, 4]. The average age of the affected women is around 27 years [5].

The definition of pregnancy-associated osteoporosis is based on the WHO definition of osteoporosis with a reduction of the T-score in the DEXA measurement under -2.5 standard deviations with or without a fracture [1]. However, there must be a direct temporal connection to pregnancy or breastfeeding.

The human bone is subjected to a continuous process of formation and resorption throughout life. About 4-10% of the total bone mass is renewed an-

nually, which is called “bone remodeling” [2]. From puberty onwards, bone growth is influenced by hormonal control, genetic predisposition and external forces. The maximum bone mass (“peak bone mass”) is reached in most people between the ages of 20 and 30 and depends on many factors. For example, gender, age at menarche, diet and consumption of stimulants such as alcohol and smoking, physical activity and genetic predisposition have influence on bone growth. In addition to the mentioned factors, hormones play a major role in the development of osteoporosis. Due to the natural drop in estrogen after menopause in women, in addition to the usual symptoms such as hot flashes, mood disorders, lipid profile changes with an increased risk of cardiovascular events, there is also a decrease in bone density. This leads to an increased risk of fractures, especially on the vertebral body, femoral neck, proximal humerus or distal radius [6].

Physiologically, during pregnancy there is a change in bone metabolism and a transfer of calcium to the fetus. In total, up to 30 g of calcium is transferred from mother to child throughout pregnancy. This is necessary for the fetus to develop the fetal skeleton [7,8]. Normally, an increase in steroid hormones such as estrogen, androgen and progesterone should counteract this negative metabolic balance. Furthermore, pregnant women experience increased absorption of calcium in the gastrointestinal tract. The maternal skeleton is available as a further source of calcium, which leads to a mobilization of calcium from the bones and thus to their weakening [2].

Prolactin increases during breastfeeding, which leads to estrogen deficiency. This physiologically reduces bone density by 5-10%. This is also reflected in laboratory chemistry with a reduction in bone formation markers such as osteocalcin and bone-specific alkaline phosphatase. Accordingly, the laboratory parameters for bone resorption (N-telopeptide/NTX, deoxypyridinoline/DPD and hydroxyproline) are increased [2].

In the initial phase of bone density reduction, the patients usually have no symptoms. Symptoms usually occur in the last trimester of pregnancy due to the increasing strain on the back from hyperlordosis or during breastfeeding due to a further reduction in bone mass due to the release of prolactin. The symptoms often begin with severe pain in the thoracolumbar area or the lumbar spine. The affected women also describe pain in the hip joint or ankle.

The diagnosis of pregnancy-associated osteoporosis is made by the occurrence of typical atraumatic

vertebral body or femoral neck fractures and a reduced T-score in the DEXA measurement. Of course, a secondary cause of osteoporosis must be ruled out before. Due to a misinterpretation of the symptoms as a natural overload during pregnancy or when carrying the child, the diagnosis is often delayed. In addition to a detailed anamnesis and physical examination, diagnostic equipment options are available.

Classic X-rays of the spine are primarily used to diagnose severe back pain. Morphological changes such as collapses in the end plates, vertebral deformations (wedge vertebrae and fish vertebrae) and fractures can be diagnosed using this imaging method. Due to the radiation exposure, radiation-free MRI (magnetic resonance imaging) is recommended during pregnancy. With the MRI, a good assessment of possible fractures of a vertebral body can be achieved [9].

The standard method for determining bone density is DEXA measurement (dual X-ray absorptiometry). Bone density can be determined by measuring the attenuation of photons or X-rays by the hydroxyapatite of the bones. The typical measurement locations are the lumbar spine and the femoral neck region. There are inconsistent results in the literature for the use of DEXA in pregnant women. In addition to a reduction in bone density [10], there was also an increase in bone density [11] or bone density remained the same [12]. The average radiation exposure during a DEXA measurement is 30µGy, which accounts for about 5% of the natural radiation during the entire pregnancy [13].

Newer measuring methods do not require exposure to radiation. With the radiofrequency echographic multi spectrometry (REMS) method, for example, the bone density is determined by means of the different absorption and reflection of ultrasonic waves. The bone density is measured at the lumbar spine and the femoral neck region. The REMS method has already proven that it gives comparable results to the DEXA measurement [14].

There are currently no uniform recommendations for the treatment of pregnancy-associated osteoporosis. In the literature, drug therapy with bisphosphonates [15], teriparatide [16] or basic therapy with vitamin D and calcium is recommended [2]. If the symptoms are severe due to a comminuted fracture, additional surgical procedures such as vertebroplasty can be considered. However, these can have side effects such as cement leakage into surrounding tissue, paravertebral vein embolism, intradiscal leakage, leakage into the spinal canal, or pulmonary embolism [17].

CLINICAL CASE DESCRIPTION

We present a 27-year-old female patient with an acute onset of back pain 5 months after giving birth. During labor a spinal anesthesia was used for pain relief. Prior to delivery the patient did not have any symptoms or spinal pain. After visiting a neurologist an x-ray of the thoracic and lumbar spine was performed revealing compression fracture of the Th12 vertebra. Subsequently a computed tomography showed compression fractures of the Th8 and Th12 vertebrae and a suspect height loss of the Th5, Th7 and L1 (Fig. 1). The bone density was measured

using DEXA with values of the T-score at hip neck -2.5 SD (total) and -3.5 SD (L1-L4) at spine. The compression fractures of the Th8 and Th12 were then treated with vertebroplasty. A post-operative CT showed cement leakage and extravasation, as well as bilateral cement embolism of the proximal branches of the pulmonary arteries and progression of the height loss of Th5, Th7 and L1 (Fig. 1 and Fig. 3). The patient denied having episodes of breathlessness, chest pain, cough, fever or hemoptysis after her discharge from hospital. There was no history of any chest surgery or trauma.



Fig. 1. Computed tomography of the thoracic and lumbar spine showing compression fractures of Th8 and Th12 (left) and after treatment with vertebroplasty (right)

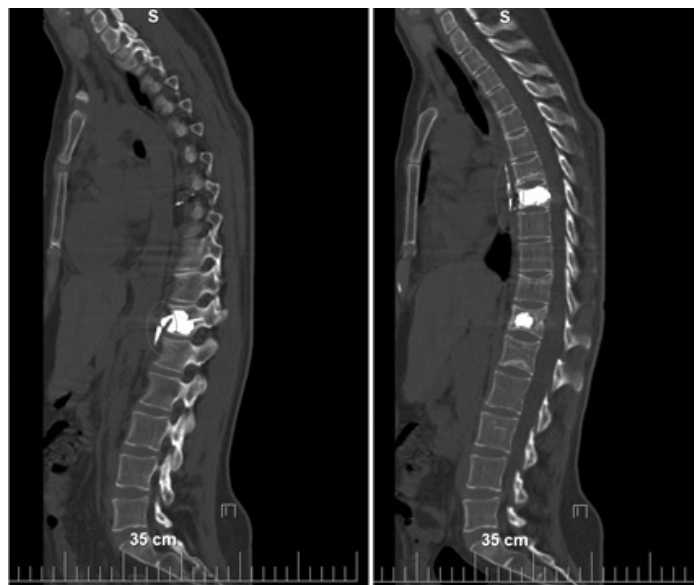


Fig. 2. Computed tomography of the thoracic and lumbar spine showing leakage and extravasation of the bone cement



Fig. 3. Computed tomography showing bilateral pulmonary cement embolism

DISCUSSION

Pulmonary cement embolism is a rare complication of vertebroplasty [17, 18]. Another method for injection of bone cement into the vertebral body the kyphoplasty poses lesser risk for this kind of complication [19]. The mechanism usually includes an extravasation of cement in the venous system of the vertebra and migration to the lungs (Fig. 2). The number of patients without symptoms is significantly higher than those who experience chest pain and dyspnea [20]. The condition rarely leads to the severe acute respiratory distress syndrome.

Cement leakage is a more frequent complication of vertebroplasty, although most of the time asymptomatic [21]. Cement can leak in the intervertebral disk space, intervertebral foramen or spinal canal, causing nerve root or spinal cord compression [17, 22]. The manifestation of these symptoms is usually immediately after surgery, although cases of delayed onset have also been reported [23]. The treatment may vary from surgical decompression to conservative management depending on the severity of the symptoms.

The risk of complications such as cement leakage and pulmonary cement embolism makes the alternative conservative treatment worth considering before proceeding to the surgical interventions. [24] Analgesics, rest and spinal orthoses are the first-line treatment followed by the very important management of the primary disease the osteoporosis. The back muscles training and strengthening is a crucial component for subsiding future chronic back pain. Furthermore, injecting bone cement in the fractured vertebra poses a risk for additional fractures of the adjacent vertebrae. Only after failure to achieve adequate pain management kyphoplasty or vertebroplasty should be considered, due to the risks of prolonged immobilization of the patient leading to further bone and muscle loss.

CONCLUSION

Pregnancy associated osteoporosis is very rare. Due to the fact that an ultrasound-based determination of bone density does not involve any radiation exposure, we recommend the REMS method, for example, for pregnant women.

For treatment we recommend an interdisciplinary decision making. Vertebroplasty is commonly used in the management of spine fractures and offers a satisfying pain relief and rapid mobilization of the patient. Despite that, these interventions pose

a risk of numerous complications. The osteoporotic fractures of the vertebrae are usually stable and a conservative treatment prior to surgical interventions should always be considered.

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