

Delayed Post-Traumatic Vertebral Body Collapse "Kummell Disease": Case Report

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ABSTRACT

Kummell disease is a relatively rare group of conditions, which refers to a lack of blood supply to the bone leading to collapse due to poor nourishment. It typically presents in the elderly patients' thoracic vertebrae, as a compressive deformation of the vertebral body as a result of minor trauma experienced weeks to months before the onset of the disease. Osteoporosis tends to be the biggest risk factor for Kummell disease, hence its high frequency in the affected patient population. Most cases of osteoporotic vertebral compression fractures stay asymptomatic, therefore the detection remains accidental. The treatment chosen for specific cases should be established via monitoring any development of the condition so that the decision of introducing a surgical method is not delayed. This remains the aim of treatment, to not overlook the point when the conservative methods allow progression of the disease to become thunderbolt and mark the bone with irreversible pathologies. In this case, we present an appearance of Kummell disease in a patient suffering from osteoporosis. We used an innovative solution for successful therapy- the SpineJack® system, which was used instead of conservative management, which led to undesirable side effects in the case of this patient.

INTRODUCTION

Osteoporotic Vertebral Compression Fractures (OVCFs) are occurring spontaneously from trauma, which would not affect the healthy skeleton with such consequences normally. Patients incoming to the outpatient clinic often present with back pain, occurring after a fall, causing a sustained injury to the weakened bones [1]. Kummell Disease (KD) is defined by post-traumatic vertebral body collapse, initially presenting asymptotically [2].

The treatment of KD is controversial, whether to be nonoperative or operative. In patients, in whom neurogenic pain occurred and even a slight kyphosis developed, Minimally Invasive Surgery (MIS) represents a great chance for the success of therapy [3]. The solution seems to be simple if we decide on conservative management. It should be strongly in accordance with the multiple approaches to the injury. The patient staying under continuous orthopedic care does not progress to serious stages of the disease, because it is treated on time. The asymptomatic process of the injury leads to a high susceptibility for further damage and lowers the chances of the treatment to be sufficient [4].

Patients suffering from KD are most frequently affected by a fracture appearing in the thoracolumbar zone. According to the systematic review (Muratore et al.) released

in 2018 describing the risk factors for failure of conservative methods used for 1203 patients with OVCFs, this region stands for an increased susceptibility to nonunion [5]. Therefore, what we try to visualize with this study is the prudence being an unavoidable feature for determining a treatment method for patients suffering from vertebral fractures. This study has evidenced that even though conservative management generally leads to good results in the majority of cases, patients suffering from impaired healing potential and those who had experienced fracture at the T-L level are prone to not benefit from nonsurgical methods. Those are the cases strongly related to poor recovery prognosis, prolonged back pain, decrease in daily functioning, and higher risk for fractures of the adjacent vertebrae [5].

METHODS

The findings of the following case report were conducted based on the clinical experience of treating the patient admitted to the hospital with developed KD. Therapeutic management was chosen according to Clinical Practice Guidelines, recommendations for optimized care obtained from systematic reviews research, described in evidence, and an assessment of the benefits and harms of all alternative options. The content of the manuscript was composed and checked in line with 'The CARE Guidelines: Consensus-based Clinical Case Reporting Guideline Development'.

CASE REPORT

Specific information and chief complaint

A 67-year old female patient was admitted to the hospital because of a severe, acute deterioration of her back pain on the level of the thoracolumbar zone, being a consequence of an aged injury, acquired by a fall experienced more than one year ago. She was diagnosed with a T11 vertebral fracture, probably as a consequence of osteoporosis, which already had been detected previously. The patient reported constant back pain for 2 years.

Past interventions and outcomes

She was wearing an orthopedic corset soon after detection of the fracture, but with no consequential improvement for one year (Figure 1). Furthermore, she underwent rehabilitation and was prescribed analgesics. Lately, during an admission to the hospital, she complained of pain radiating to her scapula, limiting her upper extremity maneuvers and markedly

diminished spine movements. She noticed difficulties with her mobility during her daily activities. Additionally, she had acquired a kyphoscoliosis and she presented with hypersensitivity of the skin in the region from T9-T11 thoracic vertebrae and noticed a decrease in height. In previous investigations, she got diagnosed with osteoporosis (Table 1) and degenerative scoliosis. Likewise, the examinations have shown a fracture of the T11 thoracic vertebra with a markedly collapsed vertebral body.

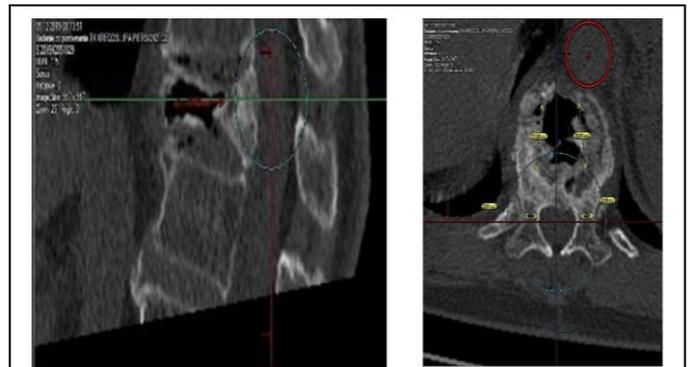


Figure 1: CT images of the vertebrae injured from OVCF of a patient with developed KD after a usage of conservative treatment.

Table 1: BMD test performed on a patient.

Bone mineral density test: USA (NHANES/ Lunar)									
Region	BMD (g/cm ²)	YA (%)	YA T-score	AM (%)	AM Z-score	BMC (g)	Surface (cm ²)	Width (cm)	Height (cm)
L2	0,884	74	-2,6	88	-1,0	9,71	10,98	4,2	2,62
L3	0,852	71	-2,9	85	-1,3	11,58	13,59	4,2	3,27
L4	0,761	63	-3,7	75	-2,1	11,73	15,42	4,4	3,48
L2-L4	0,826	69	-3,1	82	-1,5	33,02	39,99	4,3	9,37
L2-L3	0,866	72	-2,8	86	-1,2	21,29	24,57	4,2	5,89
L3-L4	0,804	67	-3,3	80	-1,7	23,31	29,01	4,3	6,75

Diagnostic assessment

In patients with OVCFs, it is important to involve radiological assessments of the vertebral column to find emergency solutions for the injury. A computed tomography (CT) scan provides detailed information about the bony elements' injuries via the sagittal and axial plane and it is mainly used to make a final diagnosis since it can prove the underlying condition with sufficient evidence [6]. The tool allows early recognition of pathologies [7]. Magnetic Resonance Imaging (MRI) is a useful tool enriching the investigation with additional information. It is

clarifying the clinical picture, revealing information about the eventual involvement of soft tissues and the onset of asymptomatic progress of the disease [8].

Interventions

KD facilitates failure of a fracture's healing process, therefore the decision on the invasiveness of the therapy must be according to the injury. An ischemic area develops, eliminating healing potential and encouraging atrophic or a vascular nonunion [8]. Patients with OVCFs with nonunion and back pain with or without symptoms of neurogenic compression are candidates for surgical stabilization [9-11]. OVCFs mainly start to bother patients when severe sudden-onset pain occurs, there is limited mobility, height loss, and deformity or disability. Pain related to vertebral compression fractures can last up to 3 months until it may subside naturally. It was observed in some individuals that it can decrease within this time significantly [11]. According to other studies, up to a third of patients will unfortunately not respond successfully to conservative therapy alone while dealing with OVCFs [12], due to the coexistence of other features facilitating treatment failure. This is the reason why the analysis of the patient's condition must be performed thoroughly and individually. On the one hand, the crucial issue is not to decide for surgical or invasive methods too quickly. But on the other hand, the conservative therapy in the case of our patient simply allowed the condition to exacerbate. The compression of the vertebral body deteriorated to the point that a restoration of the physiological height was not possible anymore [13,14]. Therefore, it is recommended to permanently control the injury and whenever a slight deterioration appears, to decide for an efficient and modern method of treatment. The aim remains to prevent chronic pain from appearing, which may be the result of using bracing over time, unfortunately.

Conservative treatment

Bracing limits the Range of Motion (ROM), provides support for weight-bearing, decreases postural flexion, and provides axial support if muscle fatigue and spasms are present. This is considered to be favorable for the healing of injured bony structures. Nevertheless, it is controversial whether bracing is an effective method in spinal injury and provides better outcomes on follow-up [15]. Over-the-counter pain medications are often effective in managing the pain but do not shorten the healing process. Physical therapy was also found to be beneficial at

the very onset, especially when there are no symptoms present, but a compact injury was detected during screening investigation [16].

Surgical treatment

The ineffectiveness of conservative management, neurological complications, pain limiting the patient's ROM, the degree of kyphotic deformity, and neurogenic claudication, all influence the decision of performing a surgical attempt to improve the condition and prevent further deterioration of the impairment [3]. Current experience with conservative treatment, leaves the significant conclusion, that prolongation of the period when the patient is becoming classified for surgery is a false attitude. Referring to Official Publication of the European Spine Society, the European Spinal Deformity Society, and the European Section of the Cervical Spine Research Society, since the epidemiology for osteoporosis and its complications stay at such a high risk and result in increased morbidity and mortality, it is crucial to notice how serious musculoskeletal, spinal and neurological impairments can be. This makes surgery a suitable approach of therapy. After the development of severe neurological compromise, being a result of kyphosis, and ranging from paraplegia to paraparesis, the chance for a satisfying recovery gradually declines [17]. Percutaneous vertebral augmentation (vertebroplasty and kyphoplasty), which has an important role in achieving pain relief, restoring vertebral body height, and correcting deformity has been well argued [16,18].

Vertebroplasty is well accepted as a safe and effective MIS for OVCFs. The risk of cement leakage, which is quite a common complication, can however be diminished by the usage of balloon kyphoplasty.

Nowadays, the newest method is the SpineJack[®] implantable fracture reduction system. The advantage of this method over traditional anterior augmentation procedures is that the SpineJack[®] system allows for the achievement of the previous height of the vertebral body [19], it can be used on an outpatient clinic standard and can lead to significant improvement of the quality of life for the patients [20,21]. Furthermore, a study performed by Krüger et al. on 108 patients treated with this method reports that the postoperative observations have shown a significant improvement in back pain, maintained in a 12-month follow-up period [20] and

often a lack of complications (Figure 3). The results of trials present that the overall effectiveness of the SpineJack® method is situated above kyphoplasty. Patients were divided into groups according to the treatment method performed. Those treated with kyphoplasty required a longer operation time and a significantly larger amount of polymethylmethacrylate injected. Furthermore, the postoperative increase in vertebral body height was much closer to the original size in the SpineJack® group than in the kyphoplasty group [19]. A review published by Lewis G. underlines many shortcomings of kyphoplasty, besides its effectiveness in specific individual situations. A main issue detected in the mentioned manuscript is harm to the trabecular bone in the injured vertebral body during the bone tamp inflation. Even though, thanks to its overall benefits, balloon kyphoplasty is widely used to treat patients with severe and persistent pain, arising from osteoporotic complications, that is not alleviated nonoperatively [22].

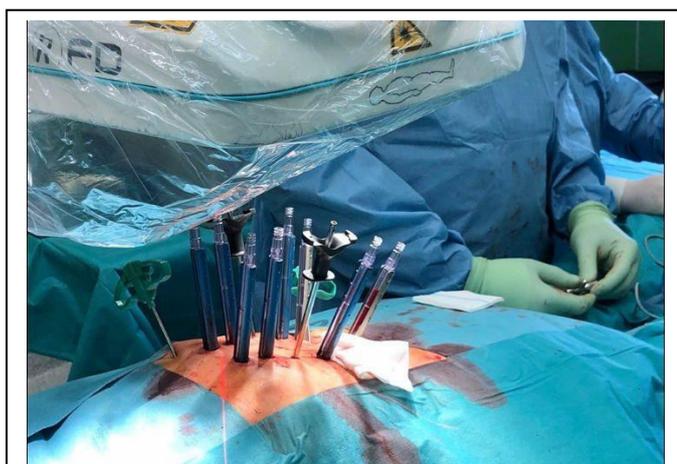


Figure 2: X-Ray guided SpineJack® system procedure.

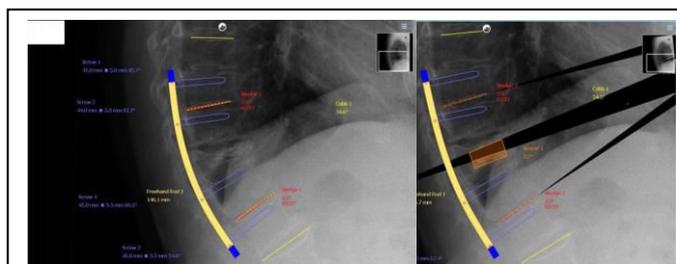


Figure 3: A Preoperative and a postoperative simulation of effects of chosen methods. A visualization of the repositioning of a collapsed vertebra (SpineJack®), screw fixation and vertebroplasty with an achieved curve correction in kyphoscoliosis (from 34,6° to 24,5° Cobb angle).

Follow up and outcomes

The treatment of this patient was based on the SpineJack® system (Figure 2), percutaneous transpedicular fixation of the vertebrae T9-L1, using bone-cement screw fixation. The stabilization of the vertebrae achieved by this therapeutic method was accomplished by vertebroplasty of the T8 thoracic vertebra and the L2 lumbar vertebra. The reason for that was the need to strengthen the zones just below and above the affected area to prevent them from experiencing any future fracture. The chosen therapy aimed for the highest possible restoration of the height of the collapsed vertebrae, achieved with the SpineJack® system. Subsequently, percutaneous transpedicular fixation was meant to strengthen and align the vertebral column's thoracolumbar part. During the establishment of the treatment plan, we kept our focus on multifactorial-based methods, involving deliberation of any possible adverse effects of therapies, to prevent their occurrence. During a 2 month follow-up period, the outcome remained satisfactory, there was neither loosening nor regression of any of the inserted screws. The conservative treatment our patient underwent, provoked the occurrence of a markedly diminished vertebral height and neurological symptoms. With the decision on SpineJack® height restoration and MIS percutaneous transpedicular fixation using bone-cement screw augmentation, the patient improved to the point of being satisfied with daily life functioning. The comparison of angulation of the patient's T9-L1 region before the surgical attempt and after the operation during the follow-up period (Figure 4,5) visualize an outstanding improvement in the general condition.



Figure 4: Comparison of X-rays planes in upright position with a vertebral body collapse (preoperatively) and in 2 months check-up examination.



Figure 5: Imaging of vertebral body height restoration achieved with an introduced surgical approach.

DISCUSSION

The case described in the following report was not under the care of our clinic since the onset of the condition, which caused some limitations. The patient came after the conservative approach failure at another center, therefore our perspective of the disease development is quite limited, due to lack of some parts in the medical history in the patient's file. Besides for the reason of progression of some other health issues in the patient, we could not collect all of the required items (for example enrich the case report with the comparison of the condition before usage of bracing and its alleviation afterwards). However, based on the patient's complaint and the status of degenerative changes we investigated, we conclude the deterioration as a result of the nonuse of preventive treatment before KD appearance after OVCF occurrence and not constantly following the condition after qualification to conservative management. The decision on further management was established according to Clinical Practice Guidelines, including recommendations for optimized care, which were gathered from systematic reviews research, described in evidence, and an assessment of the benefits and harms of any alternative options.

We aimed to underline the significance of a rational approach to patients suffering from any osteoporotic changes because as it is evidenced in the example of our patient, underestimation of possible deterioration leads to irreversible pathologies, which could be avoided when preventive tools are used early enough. According to the conducted guidelines and publications research, we encourage SpineJack® as well as vertebroplasty and kyphoplasty to be reasonable and prospective possible

preventive tools, before serious side effects and deterioration, such as the development of KD occur.

CONCLUSION

No standard or preferred treatment for KD exists currently. Largely, conservative treatment methods have been announced as less effective since they have been proven to increase the risk for delayed neurological deficits, but since patients with osteoporosis can suffer from KD simultaneously, we should pay marked attention to the best possible therapy because of a decreased healing potential. Bone cement-augmented screw fixation combined with the SpineJack® system are a promising and safe possibility for treating KD and can be described as achieving a satisfactory correction of kyphosis and vertebral height, with noticeable pain relief and improvement in neurological function [23]ippling neurological complications and painful deformities over time. Operative methods are the sole alternative strategy and provide a sophisticated opportunity. The clinician then, being supported by up-to-date knowledge of the best options in surgical treatment, can satisfactorily and invulnerably manage the problem [18]. Generally, MIS brings an outstanding improvement of the patient's condition at follow-ups, with adequate pain relief, kyphosis reduction, and a decrease in side effects of other fractures. Several studies evidence that surgical methods are efficacious with less risk for complications than conservative treatment [24]. Overlooking the asymptomatic presence of OVCFs leads to a delayed diagnosis and treatment and leaves a greater risk for neurological symptoms to develop [23]. Anyone who experienced a vertebral fracture should undergo therapy from a wide spectrum of methods, after assessment of BMD, CT and MRI scans and personal features. Since OVCFs are the leading cause of disability and morbidity in the elderly [24] and KD affects patients suffering from those, the restoration of previous daily functioning and enhancement of the quality of life remains a priority.

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