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# Multilevel Compression Fracture Initiated by Unrestrained Electroconvulsive Therapy for Treatment Resistant Depression Case Report

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**Background:** Depression is the most common cause of emotional disorders in older adults with electroconvulsive therapy (ECT) as the preferred treatment for older adults. ECT utilizes a controlled therapeutic seizure resulting in repetitive muscle contractions, which carries the risk of fractures and dislocations.

**Case Report:** This is an unusual case of a 69-year-old man with a history of treatment-resistant depression developing severe midback pain and a multilevel compression fracture after treatment without a well-defined incidence following utilization of ECT. Anteroposterior and lateral x-rays of the thoracic spine demonstrated a 2-level compression. The patient was a candidate for kyphoplasty. Bone density was age appropriate. On follow-up, the patient denied pain with healing of the fracture without augmentation. Initiation of physical therapy was recommended.

**Conclusions:** Individuals with age-appropriate nonosteoporotic bones can develop fractures during ECT. Back pain following ECT may be associated with a vertebral compression fracture, especially in older adults.

**Key words:** Vertebral compression fracture, electroconvulsive therapy, non-osteoporotic fracture, kyphoplasty

## BACKGROUND

Depression is the most common cause of emotional disorders in older adults causing functional impairment and leading to lower quality of life (1). Among the different therapies available for depression, electroconvulsive therapy (ECT) is a preferred treatment for older populations when compared to conventional treatment due to its better treatment response than younger adults, lower risk of side effects associated with antidepressants, as well as pharmacologic interaction and rapid effects (2,3). However, ECT utilizes a controlled therapeutic seizure resulting in repetitive muscle contractions, which carries the risk of fractures and dislocations, with up to 50% of patients experiencing compression fractures of the spine, extremities, and teeth (3,4). Therefore, the use of the administration of intravenous muscle paralytics, depolarizing and nondepolarizing, is an important patient safeguard.

This is an unusual case of an elderly man with a history of treatment-resistant depression who underwent unmodified ECT developing a multilevel compression fracture after treatment without a well-defined incidence of a fall, or other trauma. In this patient, increased susceptibility for skeletal fractures may have been related to prostatic issues involving the prostate itself or due to treatments for the prostate.

### Clinical History

The patient was a 69-year-old man with a recent history of depression initially treated with a selective serotonin reuptake inhibitor, but he was transferred to ECT upon failure of improvement. His only other relevant

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condition included prostatic obstruction for which he had taken unspecified antiprostate medication of an unknown type, but he had stopped due to a desire for nonpharmaceutical treatment utilizing papaya and fish oil. No other relevant prior history, including medical history nor family history was present.

Shortly after the initial ECT treatment session, the patient reported having severe midback pain without a history of recent trauma that occurred prior to or subsequent to ECT utilization. Upon presentation, anteroposterior and lateral x-rays of the thoracic spine were taken and read by an orthopedic surgeon as a 2-level compression fracture at the level of T7 and T8. This patient was identified as a candidate for a 2-level kyphoplasty and was referred to a rheumatologist for osteoporosis treatment. The expected outcome via the utilization of kyphoplasty would have been the immediate reduction or elimination of pain. The patient desired to delay initiation of the vertebral augmentation for personal reasons relating to alleviating his depression without the utilization of ECT. A recommendation of temporary restriction to reduce pain and prevent additional vertebral fractures was provided for the patient. An additional recommendation for a dual-energy x-ray absorptiometry (DEXA) bone scan was provided to determine bone density.

On follow-up, the patient reported a significant decrease in pain such that it was undetectable. Bone density was determined to be age appropriate. Subsequent x-ray imaging demonstrated a now well, healed, and stable compression fracture. He reports that his pain is absent and has begun resumption of normal activities. Initiation of nonoperative management has begun to improve the patient's recovery.

## DISCUSSION

ECT is a well-established treatment option for patients with severe and medication-resistant depression, mania, schizoaffective disorder, catatonic symptoms, and suicidal ideations (3,5). This protocol addresses the needs of the geriatric population as previously described improving their quality of life. Preprocedural evaluation for ECT should be performed. Patients should also be made aware of possible underlying factors that could increase the likelihood of injury to the patient during ECT treatment. Strategies to minimize possible complications should always be used such as the usage of muscle paralytics.

The patient had the presence of an acute compression fracture. Based on the presence of an appropriate bone density along with appropriate healing (without vertebral augmentation), this would indicate that the patient's bone was of good quality and would not typically suffer such an injury without sufficient force. This was unexpected due to the presence of a multilevel compression fracture that had failed to resolve and a decreased mineralization in the patient's bones that was classified as age appropriate on DEXA imaging. His initial response to the vertebral fracture and recovery appears consistent with a self-limiting vertebral fracture (6,7) rather than one that is the initiator of degrading quality of health (8).

A similar case (9) has been previously described involving a 29-year-old woman with diagnosis of prepartum depression who was started on ECT due to side effects of former depression medication. She underwent a pre-ECT examination based on blood tests, x-rays, urine analysis, and general orthopedic examination. Preoperative osteoporotic screening was not performed. After a bilateral electroconvulsive session was completed, she reported severe back pain associated with a one-level compression fracture at the level of T6 (9). When compared to this case, there is significant similarity, especially in regard to the presence of a vertebral compression fracture in a nonosteoporotic patient relating to the usage of ECT.

Sufficient utilization of a neuromuscular blockade should also be utilized such that motion during ECT is minimized. In geriatric populations, muscle paralytics have a decreased clearance time with a similar potency when compared to a nongeriatric patient (10). Twitch suppression is a metric used to determine whether a sufficient neuromuscular blockade has been achieved with the current degree of twitch suppression at > 90% (11). This patient's twitch suppression at the time of ECT was not available for review.

The specific type of neuromuscular blockade (depolarizing or nondepolarizing) is patient dependent. For the majority of patients, the utilization of a short-acting depolarizing neuromuscular blockade, typically succinylcholine, is preferred due to the short duration of blockade, which is only needed during active ECT administration (3,11-15). The short duration of action is still sufficiently long enough for coverage during ECT without long-term complications in regard to rapid recovery without residual paralysis (15). In patients with contraindications for depolarizing neuromuscular blockade, such as malignant hyperthermia, elevated po-

tassium, deficiency of pseudocholinesterase, etc (15-17), rocuronium or other nondepolarizing neuromuscular blockades should be utilized (3,13,15).

Based on this unique case, it is important to confirm via testing that sufficient twitch reduction has occurred, which may include allowing for sufficient perfusion of muscle paralytics with accompanying sufficient postprocedural recovery time.

Utilization of prostatic agents are associated with reduced bone density or increase the likelihood of a fracture. In this patient, prostatic agents may or have not been used with potential contributions to increasing the likelihood of a vertebral compression fracture. Commonly used agents that would be suspected og decreasing the likelihood of bone density are hormonal agents used to treat various conditions.

In benign prostatic hyperplasia (BPH), the relevant agents are 5$\alpha$-reductase inhibitors, such as finasteride and dutasteride. These agents are not associated with a reduction of bone density. Additionally, dutasteride is associated with an increase in bone density (18,19). Due to this occurrence, bone density should not be expected with BPH treatment. The appearance or suspicion of decreased bone density in combination with apparent prostatic obstruction is potentially related to prostatic metastasis.

In regards to treatment of prostate cancer, the relevant agents are gonadotrophin-releasing hormone (GnRH) agonists, GnRH antagonists, abiraterone, and nonsteroidal antiandrogens. GnRH agonists and antagonists are associated with significant bone loss (20,21). Abiraterone is a newer treatment, which is not likely to have reduced bone density (22) and may potentially be associated with preventing bone loss and promotion of new bone growth (23). For nonsteroidal antiandrogens, commonly used agents include flutamide, ketoconazole, enzalutamide, and bicalutamide. Flutamide and ketoconazole are typically used in combination with GnRH agonists. No specific information in regard to the effect on bone density in prostate cancer treatment was found. However, similar therapy for the treatment of polycystic ovary syndrome showed that the utilization of ketoconazole prevents bone loss due to GnRH agonism usage, while flutamide fails to prevent bone loss (24). Enzalutamide and bicalutamide are associated with a stable bone density (25) with bicalutamide associated with an increase in bone density (26). It would be appropriate to utilize treatment protocols that utilize bone-building or bone-stable agents. In patients that were nonresponsive to treatment utilizing such protocols, utilization of agents, such as ketoconazole that would prevent or at least reduce bone loss, should be utilized to minimize or mitigate potential fractures.

This patient's age had appropriate bone density and was not diagnosed with osteoporosis upon appropriate DEXA scan. This diagnosis of nonosteoporosis corresponds with the lack of prior history of a fracture. ECT is a known cause of a fracture, but it should not be common due to preventive measures, such as the induction of a neuromuscular blockade. In patients with known osteoporosis or spinal injuries, it is well known and recommended that a neuromuscular blockade is utilized to prevent injuries (13,27,28). However, geriatric patients, who tend to have a lower than typical bone density than nongeriatric patients (29), are more likely to develop fractures when compared to a younger population even with nonosteoporotic bone classification. This increased susceptibility with the trigger of ECT with an insufficient neuromuscular blockade is likely the cause of this patient's fracture.

The strengths of this case report are in regard to the unique circumstances of the trigger of a multilevel compression fracture with the sole likely cause as a single utilization of ECT. This case along with similar cases indicates that there is a need to appropriately examine patient's complaints of pain after the utilization of ECT and other such therapies that may result in similar injuries. Geriatric patients are also more susceptible to have skeletal fractures, including, but not limited to, vertebral fractures due to having a lower bone density even when classified as age appropriate without classification of osteopenia or osteoporosis.

The weakness of this case report is in regard to the clinical picture of the patient overall, including the potential origination of this patient's multilevel compression fracture. While there is suspicion that a prostatic issue may have contributed to the fracture, a clinical picture of the patient's prostatic condition is unknown and could have resulted in a flaw in the vertebral body that made it more susceptible to a fracture upon the trigger of ECT. Additionally, the utilization of ECT, while believed to be the trigger of the multilevel compression fracture, may potentially not be the trigger with an unknown high-energy event, such as uncontrolled seizure, not utilizing ECT, or an automobile incident involving a collision or sudden stop.

## CONCLUSIONS

As seen in this case and with others, individuals with age-appropriate nonosteoporotic bones without history of fracture or trauma can develop a fracture during ECT. We aim to reassure the importance of sufficient utilization of muscle paralytics in ECT therapy in all populations. As such, it is appropriate to ensure that geriatric patients have sufficient neuromuscular blockade to reduce the rate of ECT-associated injuries. Pain following ECT may be associated with a fracture especially in older adults even without factors predisposing the patient to fracture and should be ruled out when suspected.

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