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ORIGINAL PAPER

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Wrist fracture in a patient undergoing electroconvulsive treatment monitored using the "cuff" method

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Abstract We report on a case of a 64-year-old female patient who received electroconvulsive treatment for major depression. The patient sustained a fracture to the distal radius of the arm blocked by the "cuff" method (Smith fracture). Subsequent investigations revealed that she was suffering from osteoporosis. This case report underlines the importance of special treatment procedures for osteoporotic patients and other patient groups at risk for fractures. We recommend screening for osteoporosis in routine pre-ECT evaluation, even in younger patients, and propose not attaching the cuff to the arm in those at risk for fractures. In our patient, electroconvulsive therapy was safely continued using higher doses of succinylcholine and without the cuff method.

Key words electroconvulsive therapy · cuff method · fracture · osteoporosis · depression

Introduction

The introduction of muscle relaxants to electroconvulsive treatment [3, 9] has minimized the risk of long bone and vertebrae fractures [2, 6, 10]. In order to monitor the ictal motor activity in patients who receive a muscle relaxant, the "cuff method" is used [1, 8]: Prior to administration of the muscle relaxant, a blood pressure cuff is attached to the arm or the leg and inflated well above the expected systolic peak. This blocks distribution of the muscle relaxant in the arm or the leg. The seizure duration as estimated by the cuff method is, in general, 10 % shorter than the duration documented by EEG. However, the results of both methods are highly correlated [8]. In addition to enabling the treating physician to time the seizure, this method allows the patient to alert the treatment team in the rare event that anesthesia is insufficient, leaving a patient conscious but paralyzed by the muscle relaxant [2].

However, in patients prone to fractures, such as those suffering from osteoporosis, the use of the cuff method may lead to fractures in the extremity blocked by the cuff. In the following, we will report such a case.

Case report

At the time of admission to our clinic, the Caucasian 64-year-old female patient had been suffering from major depression for four years. She was referred to our clinic from another psychiatric department in order to receive electroconvulsive treatment after being treated with various antidepressants without response. There was no history of manic episodes, other psychiatric disorders, substance abuse, or smoking. The medical history was, however, significant for insulin-dependent diabetes mellitus, hypertension, hyperthyreosis and nodular goiter. Some years earlier, after a fall, she had sustained a Colles fracture on the right wrist. Her menopause was at 55 years. At the beginning of electroconvulsive treatment the patient was receiving the following medication: clomipramine (75 mg per day), lithium carbonate (30 mmol per day), fluspirilene (4 mg i. m. once a week), thiamazole (2.5 mg per day), ramipril (5 mg per day), and 24 IU daily of short and intermediate acting insulin.

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The physical examination of the patient (height: 1.66 m) revealed a goiter. Although free T_3 and free T_4 were slightly decreased, total T_3, total T_4, and thyroid-stimulating hormone (TSH) were in the normal range. The routine laboratory work-up showed normal results except for increased serum glucose, cholesterol, and triglycerides.

On day 3 the patient received the first electroconvulsive treatment which resulted in a seizure of 50 s duration (EEG; EMG-endpoint: 43 s). The dose of succinylcholine (80 mg) in this treatment was not sufficient for the patient (weight: 67 kg) and an attenuated generalized tonic-clonic seizure was observed. Apart from this, the ECT was well tolerated. On day 7 the second ECT was administered, prior to which the patient was medicated with atropine (0.5 mg), thiopenthal (250 mg), the nondepolarizing muscle relaxant pancuronium (0.5 mg), and succinylcholine (100 mg). The cuff was placed on the upper left arm, whereas it had been attached to the right arm during the first ECT. The cuff was inflated prior to administration of the muscle relaxant. The patient received bifrontotemperal ECT with a Thymatron DG (Somatics, Inc.; Lake Bluff, IL, USA) device delivering a bidirectional brief-pulse square current. The treatment parameters were the following: current: 0.9 A; energy and charge: 10 % and 50.4 mC; frequency: 30 Hz; pulse width: 0.5 ms; stimulus duration: 1.9 s; Seizure duration according to EEG: 49 s; ictal motor activity according to EMG: 41 s. During the second ECT the treatment team observed a tonic-clonic seizure in the left arm. A "click" was audible. A reddening over the left wrist was observed and the patient reported pain in her left arm. The wrist was tender. An x-ray of the left arm confirmed a flexion fracture of the distal end of the radius (Smith fracture, see Fig. 1). Initially, the fracture was treated with cast immobilization, and during an operation on day 21 an internal fixation was carried out.

Subsequent dual-energy X-ray absorptiometry (DXA) of the lumbar spine and the femoral neck yielded T-scores of –2.9 and –2.0, respectively. The result of the quantitative computed tomography (pQCT) of the radius was 85 mg/ml. These results indicate that the bone mass in the lumbar spine was severely reduced, whereas in femur and radius the reduction was only moderate. The laboratory results (serum calcium; parathyroid hormone; 1,25-D; 25-[OH]) were normal. The patient was diagnosed as suffering from early osteoporosis and was prescribed calcium and vitamin D.

The ECT was continued without using the cuff method and with doses of succinylcholine between 120 and 140 mg and doses of pancuronium of 1 mg. The healing of the fracture was not affected by electroconvulsive treatment, and no other musculoskeletal side-effects occurred during the course of ECT.

In our patient, electroconvulsive therapy led to a temporary improvement in the depressive syndrome. At the time of discharge, the patient's psychiatric condition had improved only slightly.

Discussion

In recent years, research has shown an association between severe depression and osteoporosis [4]. For example, in a population-based study with 1566 participants aged 65 and older, Robbins and colleagues found that depression scores in patients who had been shown to have osteoporotic bone mineral density were significantly higher than in patients with normal bone mineral density [14]. To date, the mechanism of this association remains unclear. However, several groups have speculated that endocrine factors such as hypercortisolism may play a crucial role [4].

Considering the association between depression and

Fig. 1 Radiographs of the Smith fracture of the left radius

osteoporosis, it is likely that many of the patients eligible for ECT are at risk for fractures. In addition, as the general population ages, and as treating older people with ECT is increasingly recognized as an effective and generally well-tolerated therapeutic option [13], it can be expected that the number of ECT patients at risk for fractures will increase.

Levy [11] reported a case of an 85-year-old woman who sustained a fracture to the right forearm distal from the blood pressure cuff. The patient was described as suffering from "moderately severe osteoporosis." However, no detailed information as to this statement was presented in the case report. Levy recommends either not using the cuff method at all, or placing the cuff above the right ankle. This recommendation has been adopted by other authors [2]. The present case adds further support to this recommendation.

It is noteworthy that the pQCT measurement of the radius in our patient was in the low normal range (85 mg/ml), indicating osteopenic rather than osteoporotic bone density. The DXA of the spine, however, yielded clearly osteoporotic figures (T-score: –2.9).

Considering the high prevalence of osteoporosis among depressed patients, special attention should be paid to patients at high risk for osteoporosis fracture. It might even be advisable to investigate whether it would be beneficial to make screening for relevant risk factors for osteoporosis fracture a standard part of the anamnestic interview prior to ECT. This would include personal history of fracture, history of fracture in first-degree relative, female sex, advanced age, Caucasian race, dementia, current cigarette smoking, low body weight (< 58 kg), estrogen deficiency, early menopause (< 45 years), bilateral ovariectomy or prolonged premenstrual amenorrhea (> 1 year), low calcium intake, alcoholism, inadequate physical activity, and poor health [12].

Paradoxically, this case also underlines that ECT is a safe procedure for patients with fractures as long as muscle relaxation is adequate. With higher doses of nondepolarizing and depolarizing muscle relaxants, we were able to carry out an additional 16 electroconvulsive treatments without further musculoskeletal problems. In their overview, Dighe-Deo and Shah [7] presented two of their own cases in addition to several cases from the literature, all of which indicated that ECT could be carried out safely in patients suffering from long bone fractures, vertebral compression fracture, osteoporosis, or osteogenesis imperfecta. Weller and Kornhuber [15] reported on a patient with multiple fractures and other medical complications who was treated safely with ECT. However, in such cases it is important to increase the dose of the muscle relaxant (for example, succinylcholine 1.5–2 mg/kg) and to control the muscular blockade by monitoring for a complete lack of plantar reflexes or by using a nerve stimulator [5]. The latter is generally preferable, as the plantar reflexes may be too imprecise.

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