Osteoporosis International (2019) 30:1533–1536
https://doi.org/10.1007/s00198-019-04961-4

CASE REPORT

Case report: electrical automated massage chair use can induce osteoporotic vertebral compression fracture

C.-H. Jeon[1] · N.-S. Chung[1] · H.-D. Lee[1] · S.-H. Won[1]

Received: 20 May 2018 / Accepted: 27 March 2019 / Published online: 23 April 2019

Abstract

This case report describes a case of an elderly woman diagnosed with acute osteoporotic vertebral compression fracture (OVCF) at thoracic spine after using an electrical automated massage chair (EAMC). Care should be taken when using an EAMC, especially by those with or at risk of developing osteoporosis. Osteoporotic vertebral compression fracture (OVCF) is a common problem among elderly population and presents a high burden to society. Osteoporotic fractures may occur after a minimal trauma of the vertebrae. Electrical automated massage chair (EAMC) is a device that uses a programmed algorithm to perform automated massage. The massage chair, a popular device among elderly with back pain, relies on friction and rhythmic tapping created by a motorized roller. However, research regarding the safety of this device is lacking, especially in the perspective of OVCF. We present a case of an elderly woman diagnosed with acute OVCF of the thoracic spine after using an EAMC. The patient had no risk factor for fragility fracture and experienced an abrupt onset of severe upper back pain while using EAMC. Imaging studies revealed an isolated acute compression fracture at T8 vertebra (AO classification type A1) while dual-energy X-Ray absorptiometry scan confirmed osteoporosis. The patient was treated with a plastic orthosis and oral medications for osteoporosis. After 6-months follow-up, the patient showed union of the fractured T8 vertebra and no remaining symptoms. This case highlights that OVCF can be induced by EAMC. Therefore, patients with or at risk for osteoporosis should be cautious while opting for deep tissue massage using EAMC.

Keywords Electric massage chair · Massage · Osteoporosis · Thoracolumbar fracture · Vertebral compression fracture

Introduction

Osteoporotic vertebral compression fracture (OVCF) is the most common osteoporotic fracture, which causes significant pain among symptomatic patients [1]. OVCF can be induced by minimal trauma such as low-grade fall or slip down injury [2]. Electrical automated massage chair (EAMC) is a device, which has a programmed algorithm and performs massage automatically using friction and rhythmic tapping created by a motorized roller (Fig. 1). Recently, since the EAMC is an easily obtainable and operable device, it has become a popular option for patients with chronic back pain [3]. In spite of the increasing trend in the use of massage chair, there is no proper research on the safety of this device. However, a case of a 66-year-old man who developed a vertebral fracture after a receiving a back massage from a young male masseur has been reported [4]. Similarly, OVCF could be induced by EAMC.

To our knowledge, there has been no case report of EAMC-induced OVCF. In this case report, we present a case of an elderly woman diagnosed with OVCF after using an electrical automated massage chair.

The manuscript submitted does not contain information about medical device(s)/drug(s).

✉ S.-H. Won
markwon0729@gmail.com

[1] Department of Orthopaedic Surgery, School of Medicine, Ajou University, 164, World Cup-ro, Yeongtong-gu, Suwon 16499, Republic of Korea

Case history

A 76-year old female patient presented to the emergency department with severe upper back pain. The patient had history of herniated nucleus pulposus at L4-5. There was no other remarkable history of upper back pain, thoracic disc disease, or any systemic disease-related back pain. Initial physical examination in the emergency department showed that tenderness was

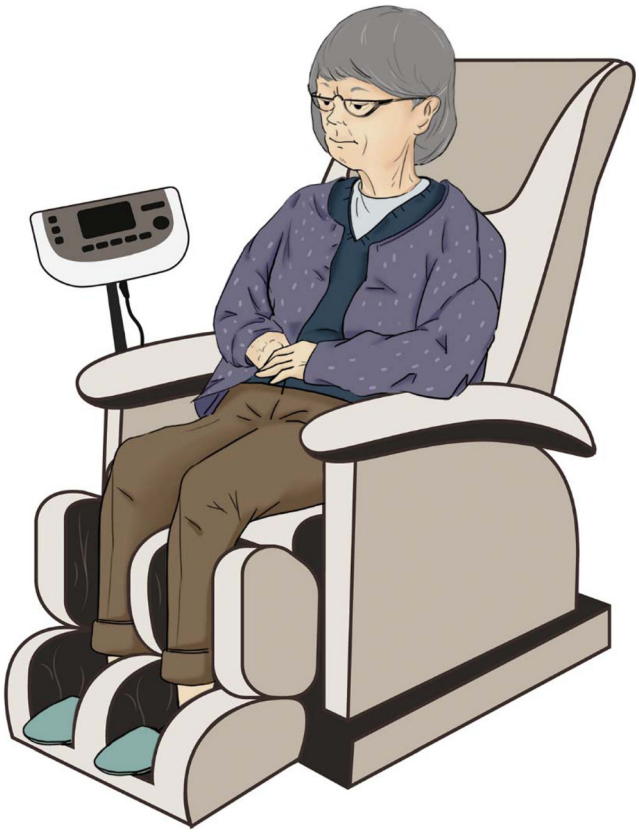

Fig. 1 A schematic diagram of electric automated massage chair (EAMC)

maximal along the point of mid-thoracic area. A plain radiograph of the thoracic spine revealed a mild decrease in vertebral height of the T8 vertebral body with a typical upper endplate disruption (Fig. 2). In addition, magnetic resonance image (MRI) of the thoracic spine revealed an acute compression fracture of the T8 vertebral body (AO classification type A1) without involvement of the posterior ligamentous complex. No signs and symptoms of pathologic fracture or neurologic compromise were noted.

The patient did not have any history of trauma. However, she experienced aggravated low back pain for 5 weeks which prompted her to use the EAMC on a daily basis. Later she replaced her EAMC to a new model with which she received a 15-min course of massage for two consecutive days. This version of the EAMC applied compression and vibration to the user's back through a built-in massage roller in a supine or sitting position. While using the new model on the second day, the patient experienced sudden onset of severe back pain which was aggravated by movement of the spine. Owing to severe pain, the patient was unable to walk or sleep for 3 days; she therefore visited the emergency department for evaluation and management.

The patient had no systemic disease other than well-controlled hypertension, type 2 diabetes (HbA1C 7.6%), and hypothyroidism (T3, 43.7 ng/dL; Free T4, 1.37 ng/dL; TSH, 2.53 ulU/m). She was never evaluated for osteoporosis in the past and had no clinical risk factors for osteoporosis, which include previous fragility fracture, hip fracture, smoking, alcohol assumption, oral glucocorticoid use or history of rheumatoid arthritis, hypogonadism, inflammatory bowel disease, organ transplantation, type 1 diabetes, over or untreated thyroid disease, and prolonged immobility [5]. She was obese with a body mass index of 31.25 kg/m^2 and her MRI showed mild fatty degeneration of back muscles. Dual-energy X-Ray absorptiometry (DEXA) revealed the presence of severe osteoporosis (T-score of L1-4, − 2.9; BMD of L1-4 0.804 g/cm^2).

Pain control was with oral analgesics, while plastic orthosis was applied to the compression fracture. Daily oral bisphosphonate therapy was initiated. The treatment regimen helped relief of pain and the patient was able to walk with the plastic orthosis applied. After 6 months, dynamic plain X-ray and computerized tomography (CT) confirmed bone union. The patient was with no other notable complications.

Discussion

As life expectancy increases, osteoporotic fracture has become a common disease among elderly population and a big burden to society [6]. Strom et al. reported that economic burden of fractures has increased in six European countries (France, Germany, Italy, Spain, UK, and Sweden), and especially the

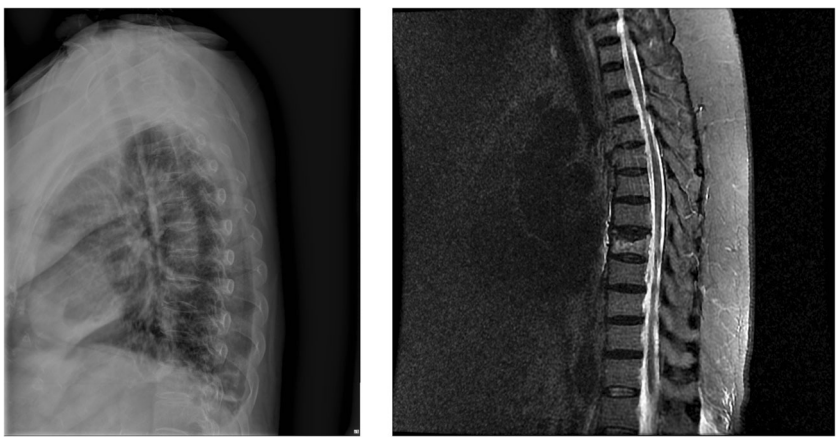

Fig. 2 **a** Lateral plain radiograph of the thoracic spine showing a decreased height of T8 vertebra. **b** T2-weighted MR image revealing an acute compression fracture at T8 (AO classification type A1)

total health burden in osteoporotic fractures were in a considerable amount [7]. The spine is the most common site for osteoporotic fractures [1]. Osteoporotic vertebral fractures constitute at least 50% of a total 1.5 million osteoporotic fractures that occur annually in the USA [8]. There is an increasing trend towards the incidence of OVCF. A study by Cooper et al. concluded that the incidence of vertebral fractures during 1985–1989 was 145/100.000 person-year in women and 73/100,000 person-year in men [9]. However in a more recent study, the European Prospective Osteoporosis Study (EPOS) group concluded that the incidence of vertebral fracture was 1070/100,000 year in European women and 570/100,000 in European men in 2009 [10]. Furthermore, the authors predicted that about 1.4 million men and women aged 50–79 years will develop a new vertebral fracture each year [10]. Patient with OVCF is subject to painful experiences [1]. Since osteoporotic spine fractures usually occur in elderly patients with multiple underlying disease, this group of patients develops long-term immobilization, poor oral intake as well as dehydration due to severe pain. Moreover, the condition can result in significant morbidity and potential mortality. Therefore, the prevalence and prevention of osteoporotic spine fracture have become an important issue in the field of healthcare business.

Prevention of osteoporotic fractures requires identification of patients at risk and application of both pharmacological and nonpharmacological methods to lower such risk factors [11, 12]. Various clinical risk factors have been identified so far [5]. A number of imaging techniques to evaluate bone status both in terms of density and quality, and biochemical markers of bone metabolism have also been developed. Various drugs intervening bone metabolism, including supplementary calcium, vitamin D, anti-resorptive agents, hormone therapy, and anabolic agents [13], have been in practice for preventing fractures of both osteoporotic and osteopenic patients. Despite the improvements in identification and treatment, osteoporotic fractures continue to increase. Management of these fractures also emphasizes the application of non-pharmacological treatment strategies. The objective of this treatment is primarily to prevent patients from developing any trauma [11, 14]. Vertebral body is inherently weak due to its architecture, which is composed of highly porous trabecular bone and shell (histologically different from cortical bone) [15]. Failure load of vertebra in elderly is lower (approximately 500 N) [16] compared with hip (3000–4000) N [17] and wrist (2000–3000) N [18]. Therefore, OVCF can be induced by minimal trauma such as reaching, bending over, and lifting [16]. So patients with osteoporosis should be warned of the fact that such minimal vertebral trauma can lead to OVCF.

Massage is a kind of physiotherapy that acts by applying pressure on the body. Massage is known to be beneficial for back pain [19, 20] and is therefore widely used. There have been several studies regarding complications of massage therapy; there is a case report of a 66-year-old man who experienced a vertebral fracture after receiving a back massage from a young male masseur [4]. Uran et al. reported a 59-year-old man who suffered 7th thoracic vertebral fracture after massage [21]. Yin et al. reported a systematic review of adverse events after massage therapy which showed that spinal manipulations have repeatedly been reported with serious adverse events such as lumbar vertebral fractures [22]. EAMC performs massage with a motorized roller. The device is gaining popularity among elders as it is easy to obtain and operate. Daniel et al. in their study demonstrated the efficacy of EAMC improving back pain [23]. Since massage and use of EAMC apply force to the body especially the back, there is a possibility of inducing OVCF. Mufarrij et al. found acute cystic rupture and hemorrhagic shock after a vigorous massage using EAMC in a patient with polycystic kidney disease [24]. No case report of a spine fracture after EAMC has been reported so far; however, considering the mechanism of EAMC, there is a possibility of fragility fracture in osteoporotic patients. Many EAMCs use built-in multiple movable rollers to perform massage on the user's back. Movements contain simple vibration, simple pressure, and parallel movement of the roller while applying pressure to the user's back (movement with pressure). While simple vibrations seem less traumatic to the user, roller movements applying direct compression to flex the user's vertebra can be a potential risk of fracture.

The case presented herein had no previous history of upper back pain or related disease other than osteoporosis. Our hypothesis was that underlying osteoporosis could have been a predisposing factor, and minor trauma to the spine through EAMC use could have triggered an osteoporotic compression fracture to the patient's thoracic spine. Thoracolumbar junction is the most commonly involved area of OVCF and mid-thoracic region is the second most common region [25]. OVCF at T8 is relatively rare, and therefore a fracture at this location could have been associated with a trauma event by EAMC. Since there have been no case reports of such OVCF after EAMC use, there are no current guidelines that mention the risks of EAMC use in osteoporotic patients [12]. We point out that guidelines regarding physical and occupational therapy should add special considerations applying EAMC to osteoporotic patients.

This case thus highlights that OVCF can be induced by EAMC. Care should be taken when using EAMC, especially by those with or at risk of developing osteoporosis. Although the provocation of fracture by EAMC has not been reported, manufacturers of EAMC must consider the risk of OVCF, give safety warning message in manual, and modify machine with mode for an osteoporotic patient. Further biomechanical study using EAMC must be conducted to confirm the safety of EAMC and establish the relationship between EAMC and osteoporotic fracture.

Compliance with ethical standards

Conflicts of interest None.

References

1. Svensson H, Olofsson E, Karlsson J, Hansson T, Olsson L-E (2016) A painful, never ending story: older women's experiences of living with an osteoporotic vertebral compression fracture. Osteoporos Int 27:1729–1736
2. Ganda K, Puech M, Chen J, Speerin R, Bleasel J, Center J, Eisman J, March L, Seibel M (2013) Models of care for the secondary prevention of osteoporotic fractures: a systematic review and meta-analysis. Osteoporos Int 24:393–406
3. Kim KB (2015) A market status of message chair and technical analysis of future IT convergence. J Korea Converg Soc 6:29–36
4. Guo Z, Chen W, Su Y, Yuan J, Zhang Y (2013) Isolated unilateral vertebral pedicle fracture caused by a back massage in an elderly patient: a case report and literature review. Eur J Orthop Surg Traumatol 23(Suppl 2):S149–S153
5. Kanis J, Johnell O, Odén A, Johansson H, McCloskey E (2008) FRAX™ and the assessment of fracture probability in men and women from the UK. Osteoporos Int 19:385–397
6. Oden A, McCloskey E, Kanis J, Harvey N, Johansson H (2015) Burden of high fracture probability worldwide: secular increases 2010–2040. Osteoporos Int 26:2243–2248
7. Strom O, Borgstrom F, Kanis JA, Compston J, Cooper C, McCloskey EV, Jonsson B (2011) Osteoporosis: burden, health care provision and opportunities in the EU: a report prepared in collaboration with the International Osteoporosis Foundation (IOF) and the European Federation of Pharmaceutical Industry Associations (EFPIA). Arch Osteoporos 6:59–155
8. Rajasekaran S, Kanna RM, Schnake KJ, Vaccaro AR, Schroeder GD, Sadiqi S, Oner C (2017) Osteoporotic thoracolumbar fractures-how are they different?-Classification and treatment algorithm. J Orthop Trauma 31(Suppl 4):S49–S56
9. Cooper C, Atkinson EJ, O'Fallon WM, Melton LJ 3rd (1992) Incidence of clinically diagnosed vertebral fractures: a population-based study in Rochester, Minnesota, 1985-1989. J Bone Miner Res 7:221–227
10. European Prospective Osteoporosis Study G, Felsenberg D, Silman AJ et al (2002) Incidence of vertebral fracture in europe: results from the European Prospective Osteoporosis Study (EPOS). J Bone Miner Res 17:716–724
11. Kessenich CR (2007) Nonpharmacological prevention of osteoporotic fractures. Clin Interv Aging 2:263
12. Cosman F, De Beur S, LeBoff M, Lewiecki E, Tanner B, Randall S, Lindsay R (2014) Clinician's guide to prevention and treatment of osteoporosis. Osteoporos Int 25:2359–2381
13. Wilkins CH, Birge SJ (2005) Prevention of osteoporotic fractures in the elderly. Am J Med 118:1190–1195
14. Karlsson MK, Magnusson H, von Schewelov T, Rosengren B (2013) Prevention of falls in the elderly—a review. Osteoporos Int 24:747–762
15. Ferguson SJ, Steffen T (2003) Biomechanics of the aging spine. Eur Spine J 12:S97–S103
16. Myers ER, Wilson SE (1997) Biomechanics of osteoporosis and vertebral fracture. Spine 22:25S–31S
17. Pulkkinen P, Eckstein F, Lochmüller EM, Kuhn V, Jämsä T (2006) Association of geometric factors and failure load level with the distribution of cervical vs. trochanteric hip fractures. J Bone Miner Res 21:895–901
18. Muller ME, Webber CE, Bouxsein ML (2003) Predicting the failure load of the distal radius. Osteoporos Int 14:345–352
19. Furlan AD, Brosseau L, Imamura M, Irvin E (2002) Massage for low-back pain: a systematic review within the framework of the Cochrane Collaboration Back Review Group. Spine 27:1896–1910
20. Furlan AD, Imamura M, Dryden T, Irvin E (2008) Massage for low-back pain. Cochrane Database Syst Rev 4
21. Uran A, Demir Y, Guzelkucuk U, Aydemir K (2014) No. 234 thoracic vertebral fracture after a back massage: a case report. PM&R 6:S139
22. Yin P, Gao N, Wu J, Litscher G, Xu S (2014) Adverse events of massage therapy in pain-related conditions: a systematic review. Evid Based Complement Alternat Med 2014:480956
23. Zullino DF, Krenz S, Frésard E, Cancela E, Khazaal Y (2005) Local back massage with an automated massage chair: general muscle and psychophysiologic relaxing properties. J Altern Complement Med 11:1103–1106
24. Mufarrij AJ, Hitti E (2011) Acute cystic rupture and hemorrhagic shock after a vigorous massage chair session in a patient with polycystic kidney disease. Am J Med Sci 342:76–78
25. Kim DH, Vaccaro AR (2006) Osteoporotic compression fractures of the spine; current options and considerations for treatment. Spine J 6:479–487