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Lumbar Spine Fracture Secondary to a Virtual Reality Game - A Case Report -

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Study Design: Case report.

Objectives: We report a case of lumbar spine fracture sustained during a virtual reality (VR) game.

Summary of Literature Review: As video games have evolved, so have video game-related injuries. Because VR gamers wear headsets that block their ability to see the surroundings, it is thought that VR gamers are more at risk than previous video gamers. However, no VR game-related injuries have yet been reported.

Materials and Methods: A 53-year-old man sustained a lumbar spine fracture during a VR game. Because the game simulated his fall from a building, he lost his balance and fell down on the floor. A compression fracture of the third lumbar vertebra was demonstrated by imaging and conservative management using rigid orthosis was done.

Results: At a 1-year follow up, computed tomography showed complete bone union of L3.

Conclusions: Even though the activity was simulated, the resulting injury was all too real. Clinicians should never underestimate the risk of VR game injuries and should consider them in the differential diagnosis of musculoskeletal injuries.

Key words: Lumbar vertebra, Compression fracture, Virtual reality game

Video game related injury was first reported by Brasington in 1990 as pain to the right thumb and called “Nintendinitis”.¹⁾ In 2006, Nintendo Wii, a console with remote controller that detects movement in three dimensions was introduced and multitude of game related injuries has come.²⁾ Apart from motion detecting controllers, VR gamers wear headset blocking ability to see surroundings (Fig. 1). Therefore, it is thought that VR gamers are more at risk than Nintendo Wii gamers. However, as far as we know, there is no reported VR game related injury yet. We report a case of 53-year-old man who presented with lumbar spine fracture sustained during virtual reality (VR) game.

experience (Toast VR Pty Ltd, Queensland, AU). Because the game simulated his fall from the 80-story building, he lost his balance and fell down on the floor covered with artificial turf. The patient had a history of hypertension with no other underlying disease. On neurologic examination, there was only low back tenderness without radiating pain or weakness in lower limbs.

Magnetic resonance imaging (MRI) of the lumbar spine showed a decreased signal intensity at L3 on a T1-weighted sequence (Fig. 3) and computed tomography (CT) confirmed

Case Report

A 53-year-old man presented to the emergence department with a complaint of low back pain in May 2018. He was playing a VR game with a headset covering his face in the arcade. VR instrument was HTC Vive (High Tech Computer Corporation, Taipei, Taiwan) using a headset and wireless controllers (Fig. 2). VR game title was Richie’s plank

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Fig. 1. VR headset completely blocking a gamer's ability to see the surroundings.

Fig. 2. Gamers use a headset and wireless controllers during VR games.

cortical breakage of the L3 (Fig. 4).

His blood calcium level was 8.8 mg/dl (8.4–10.4 mg/dl), and phosphorus level was 2.5 mg/dl (2.7–4.5 mg/dl). 25-hydroxyvitamin D level was 37.0 ng/ml (30–100 ng/ml) and C-telopeptide level was 0.121 ng/ml (50–71 aged men <0.704). Bone mineral density (BMD) T-score was -1.7 measured in L1–4 and -0.3 at the Lt total proximal femur.

Because posterior ligamentous complex injury was not

Fig. 3. T1-weighted sagittal magnetic resonance imaging shows decreased signal intensity at L3 (arrow).

Fig. 4. Computed tomographic scan shows cortical breakage of L3 (arrow).

detected on short tau inversion recovery (STIR) sequences (Fig. 5) and the patient had a normal neurologic examination, we've determined that the nonoperative treatment is sufficient.

Fig. 5. STIR sagittal magnetic resonance imaging shows increased signal intensity at L3 (arrow) and a normal low signal intensity of the posterior ligamentous complex of the lumbar spine.

Fig. 6. Computed tomographic scan shows complete bone union of L3 (arrow).

The patient was instructed to wear the rigid brace for a total of twelve weeks and took pain medication as necessary.

At the one year follow up, CT showed complete bone union of the L3 (Fig. 6).

This paper has been reviewed since IRB approval (2019-09-014).

Discussion

Video game injury has evolved since Brasington originally described Nintendinitis in 1990 as pain to the extensor tendon of the right thumb of a 35-year-old woman.¹⁾ The description of Nintendinitis has expanded to include Wiiitis and Playstation thumb.^{3,4)} The Wii was launched in the autumn of 2006 by the Nintendo Corporation. Video game injury patterns are divided between before and after the launching of the Wii. Before Wii, video game injuries were tendinitis and ulcerative variations related to simply pushing buttons or moving levers. The Wii differs from other previous gaming consoles due to its unique user interface. The controller of Wii containing accelerometers and gyroscopes can detect motion, speed, and position in three dimensions. It allows players to interact with game physically

and changed gaming environment from sedentary to active. However, this did not only start new era of recreational technology but also resulted in new types of injury, mostly traumatic ones.⁵⁾ Brown and McKenna⁶⁾ first described a Wii-related fracture in 2009. A 38-year-old man sustained an acute C7 spinous process fracture after heavily swinging his Wii game console controller. Starting with this, there have been reports of Wii related injuries which range from mild to life threatening. Wii related injuries include fractures, patella dislocation, acute cruciate ligament rupture and even massive hemothorax.⁷⁻⁹⁾

The prevalence of video game injury is known to be obscure. Some researchers independently ran website to collect cases of video game injuries.²⁾

Since virtual reality peripherals (e.g. Gear VR, Oculus Rift and HTC Vive) came to the market in 2015, VR game became widely popular. Another important event has taken place that will change injury pattern of video games. VR gamers wear a headset apart from motion detecting controllers. Wearing the VR headset will completely block ability to see surroundings, gamers have the risk of tripping and falling. Blindness to actual topography even makes gamers hard to do defensive behavior.

VR game has also a danger from the motion detecting controllers like Nintendo Wii. VR gamers can hit things because their hands are flailing rapidly in all directions during game. Therefore VR game is judged to be more dangerous than Wii.

However despite these high risks, there have been no reported VR related injury except our case. To the best of our knowledge, this is the first report of VR game related injury.

We present this case to present that as technology advances, so do the injury patterns in the gaming environment. Even though the activity is simulated, the resulting injury is all too real. Clinicians should never underestimate the risk of VR game injuries and should consider it as part of the differential for musculoskeletal injuries.

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가상 현실 게임에 의한 요추 골절 - 증례 보고 -

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연구 계획: 증례 보고

목적: 가상 현실 게임에 의한 요추 골절을 1예를 보고하고자 한다.

선행 연구문헌의 요약: 비디오 게임이 발달함에 따라 비디오 게임 관련 손상 역시 진화해왔다. 가상 현실 게임자들은 주위를 볼 수 있는 시각을 차단하는 헤드셋을 착용하므로 기존의 비디오 게임자들보다 더 위험에 처한 것으로 생각된다. 하지만 아직 가상 현실 게임 관련 손상은 보고된 바 없다.

대상 및 방법: 53세 남자가 가상 현실 게임 중 요추 골절이 발생하였다. 게임이 건물에서 추락하는 것을 가장하였으므로 그는 균형을 잃고 바닥 위에 넘어졌다. 영상에서 제 3요추 압박 골절이 관찰되었으며 경성 보조기를 사용한 보존적 치료를 시행하였다.

결과: 1년 추시 전산화 단층 촬영상 제 3요추의 완전한 유합이 관찰되었다.

결론: 가장된 활동이었더라도 손상은 완전히 현실로 나타난다. 임상가들은 가상 현실 게임의 위험성을 간과하지 말고 근골격 손상 감별의 한 부분으로 고려해야 한다.

색인 단어: 요추, 압박 골절, 가상 현실 게임

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