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Case Report

Minimum Requirement for a New Spinal Cord Injury Patient to Return to his Hobbies which Include Shark Wrestling

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Abstract

Introduction: Patient is a 31-year-old male who presents to the ED after an incident where he hit his head on a garage door causing him to fall on the ground after an attempt to run out of the garage and jump over the sensors while the doors where closing. Imaging was performed and the patient was discharged. He later returned to the ED with inability to move both lower extremities, loss of rectal tone and fecal/urinary incontinence.

Findings: CT imaging showed compression of T5 fracture. On physical exam, patient was found to have a T2 Asia C spinal cord injury with no sensation below the T2 level. His right extremity was completely flaccid and 0/5 in strength. Left extremity was 2/5 strength with hip flexion, 1/5 strength with knee extension, 2/5 strength with knee flexion and 2/5 strength with plantar flexion and dorsiflexion.

Conclusion/Clinical Relevance: After 17 days of rehabilitation, patient's lower extremity strength and sensation have improved. His right extremity increased in strength from a 0/5 to over 2/5 in strength with all ranges of motion. The left extremity also had an increase in strength starting at 4/5 in strength to 5/5 with certain ranges of motion. The objective of this case report is to demonstrate the physical requirements that need to be achieved in order for this patient to be able to safely return to his hobby of shark wrestling. Specifically, the patient must reinforce the muscles of trunk and lower extremity with an increased focus on the hamstrings muscles.

Keywords: *Rehabilitation; Spinal Cord; Injury*

Introduction and Case Report

31-year-old male with a known medical history of ADHD, bipolar disorder, diabetes mellitus type I, hypertension, and depression reported to the emergency department (ED) after an incident in the garage where the patient was attempting to run out of the garage and jump over the sensor while the door was shutting. Patient hit his head on the garage door and fell backwards. Patient went to the emergency department where scans were obtained, and he was then discharged with a plan to follow up with a specialist. Patient reported back to the ED on 04/26/2019 with inability to move bilateral lower extremity, loss of rectal tone and incontinence. Patient was initially able to walk, but then experienced numbness and tingling which progressed to his current status. CT of thoracic spine showed compression of T5 fracture and the patient was emergently taken to the operating room for T2-T7 fusion, stabilization of T5 fracture, and T3-T7 laminectomy on 04/26/2019. Patient remained with paralysis to bilateral lower extremities. After the surgery, the patient had bowel and bladder incontinence with poor pain control. Patient's urine analysis was positive for a urinary tract infection on 05/12/2019 and he was

started on Augmentin. He started to show improvement with his motor deficits in the lower extremities upon starting physical therapy and wants to get back to his independent status and his hobbies which include shark wrestling and power gliding. Patient is now a good candidate for acute inpatient rehabilitation and can tolerate 3 hours of therapy per day in order to improve his strength, balance, transfers, bladder incontinence, mobility with wheelchair as well as bed mobility, activities of daily living (ADL)s and instrumental activities of daily living (IADLs).

On initial physical exam, the patient had 5/5 bilateral upper extremities strength with full range of motion. Although the T5 fracture was treated in the operating room, he was evaluated and was found to have a T2 Asia C spinal cord injury with no sensation below the T2 level. Patient did feel pressure but sensation was diminished below the T2 level. Trunk strength was 2/5. Patient had 0/5 strength in his right lower extremity (RLE) which was completely flaccid with only passive range of motion. Patient also had 2/5 strength in the left lower extremity (LLE) with hip flexion, 1/5 strength with knee extension, 2/5 strength with knee flexion and 2/5 strength with plantar flexion and dorsiflexion. Patient was non-ambulatory at that time but did not have bed mobility. Patient did not currently have a Foley catheter but was incontinent to urine and bowel and needed catheterizations every 4 hours. He needed supervision to assist in left-right rolling in supine position, total assistance for supine to-and-from seated position. He was also unable to stand, and therefore required total assistance with sliding board for bed to-and-from a wheelchair.

Sensory

- **RLE:** Impaired to pinprick and light touch, L2, L3, L4, L5, S1.
- **LLE:** Impaired to pinprick and light touch, L2, L3, L4, L5, S1.

Deep tendon reflexes

- **Right upper extremity (RUE):** Biceps (BB)/triceps (TR)/brachioradialis (BR) 2/4.
- **Left upper extremity (LUE):** BB/TR/BR 2/4.
- **RLE:** Patellar/Achilles ¾.
- **LLE:** Patellar/Achilles ¾.

Following reassessment on day 17 of rehab stay, patient was demonstrating the following: Patient had 5/5 bilateral upper extremities strength with full range of motion. Patient was revaluated and was now found to have a T4 Asia D spinal cord injury with no sensation that could be differentiated below T4 level. Patient did feel pressure but his sensation was still diminished below T4 level. Patient's LLE hip and knee flexion/extension and hip abduction/adduction were now 4+/5 in strength. Plantar flexion and dorsiflexion were 5/5 in strength. Patient's RLE hip flexion, extension and abduction/adduction were 3/5 in strength.

Patient's knee flexion was 3/5 in strength and knee extension was 2+/5 in strength with dorsiflexion 4/5 in strength and plantar flexion 4/5 in strength. Patient was modified independent to bed mobility. He had supervision for seat pivot transfers between bed and wheelchair. Modified independent to wheelchair propulsion and the patient was able to complete the entire length of the bar with multiple trials. However, patient needed seated brakes every bout. Patient was able to stand functionally and ambulate 10 feet in the parallel bars with minimum assistance from a therapist and the use of bilateral knee ankle foot orthosis (KAFOs). The patient was now able to transfers from supine to seated position, from bed to-and-fom wheelchair, and from seated to-and-from a standing position with minimal. Dermatomes L1-L5 remain decreased to light touch and pain, however the patient was able to discriminate between touch in both lower extremities when compared to his initial assessment. With occupational therapy, patient was now able to wear both pants and underwear while in bed demonstrating increased function in RLE.

Figure 1

Figure 2

Discussion and Conclusion

In order for this patient to return to his hobby of shark wrestling, it is vital to understand what this sport entails. Wrestling is a combat sport where an athlete uses all parts of his body to defeat the opponent by pinning and pressing him down to the ground. There are very

limited articles describing shark wrestling. It is commonly performed as a hobby, or in certain cases, as a mean to insert external or internal tags in order to study shark behavior, migration and movements, speed, sex ratio, rates of travel and dispersal rate [1].

Shark wrestling is practiced in different forms. The most common form involves hooking the shark on a fishing line, reeling it in, and entering the water to pull the animal close to the shore. Certain muscle groups are crucial in order to safely execute this task. The muscles of the lower extremity are significantly important as many studies like Ugur., *et al*. [2] have found that an increase in strength of the leg muscles leads to a decrease in the risk of injury in all sports. As our patient initially had 0/5 strength in his RLE and decreased LLE strength, it is of great importance that he strengthens his lower extremity muscles in order to withstand the biomechanical forces induced from the sheering motion of the sharks. The hamstring/quadriceps (H/Q) ratio is a very good indicator of balance and is used as a determinant in the prevention of injury [3]. An imbalance of strength between these two muscle groups has a high predisposition for injury. In fact, a decrease in the coactivation of the antagonist hamstring muscles during extension loads causes an imbalance in the ratio, which increases the risk of injury [4]. In addition, Baretta., *et al*. examined that highly developed quadricep muscles also lead to a decrease in the coactivation of the antagonist hamstring muscles, thereby increasing the risk of injury. Therefore, it is important for our patient to strengthen muscles like the semimembranosus, semitendinosus and biceps femoris in order to have an appropriate H/Q ratio of 50 - 80% [5]. By doing so, he will increase his balance and be safer when he wrestles with the sharks.

Securing a seat on the sharks back can help reduce the risk of potential fatal injuries incurred from a shark bite. As these species are often low on the ground or in the water, it is important for the wrestler to maintain appropriate trunk muscles. The study by Iwai., *et al*. [6] notes that wrestlers are required to strengthen the muscles involved in sagittal movements, such as flexion and extension motions. These movements are of significance since shark wrestlers often assume a low posture in order to take control of these animals. As aforementioned, our patients trunk muscle strength was 2/5 on initial physical examination. Thus, the specific muscles that the patient needs to reinforced are the rectus abdominus, oblique muscles, paraspinal muscles, quadratus lumborum and the psoas muscle.

Sharks are known to be dangerous animals. Albeit the lack of literature review on the death toll of shark attacks, a study by Buck., *et al*. [7] noted that about 25% of present-day victims of shark attack die. In addition to being able to rip through human flesh, these animals carry many infections such as *Vibrio parahaemolyticus* and *Pseudomonas putrefaciens* which can cause severe septicemia. Therefore, it is critical that individuals involved in shark wrestling, such as our patient, maintain good physical conditioning and strengthen muscles related to this practice, particularly the trunk and lower extremity muscles.

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