Compartment Syndrome of the Arm After Cable-Wakeboard Accident

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Abstract
A compartment syndrome is an increased tissue pressure within a closed osteofascial compartment. This compromises blood flow to the muscles and nerves within that compartment, which – if not treated adequately in an early stage – results in permanent tissue and nerve damage. It most frequently occurs in the lower leg, but can also occur elsewhere when muscles are enclosed in tight fascial compartments, such as the forearm and hand. In this report a patient is described who developed an acute compartment syndrome of the arm after a cable-wakeboard accident in which his arm was strangulated. Cable-wakeboarding is an extreme sport that has become very popular over the last years. Early recognition and treatment of an acute compartment syndrome is of extreme importance since in short term necrotic muscles can lead to severe irreversible complications. Accidents with cable-wakeboarding often occur during the start. This is caused by the strong forces that are on the cable during the start. Strangulation injuries of the arm can cause a compartment syndrome of the arm. Possibly a wet-suit or dry-suit offers some protection. However, the duration of strangulation determines much of the damage. Although diagnosis of a compartment syndrome can be difficult, a high index of suspicion combined with fast and adequate treatment with a fasciotomy improve outcome and prognosis.

Key Words
Compartment syndrome · Upper extremity · Arm · Cable wakeboarding

Introduction
Compartment syndrome is an increased tissue pressure within a closed osteofascial compartment. This compromises blood flow to the muscles and nerves within that compartment, which – if not treated adequately in an early stage – results in permanent tissue and nerve damage. It occurs most frequently in the lower leg, but can also occur elsewhere when muscles are enclosed in tight fascial compartments, such as the forearm and hand.

Since there is no uniform method in diagnosing a compartment syndrome, it is important to realize that many different mechanisms can cause a compartment syndrome; even more important, the earlier the treatment the better the prognosis.

In this report, a patient who developed an acute compartment syndrome of the arm after a cable-wakeboard accident, in which his arm was strangulated, is described. Cable-wakeboarding is an extreme sport that is performed on lakes and on open water, and has become very popular over the last years. Different kind of spectacular stunts are performed at great heights, in which style and air-time are important. Wakeboarding can be performed behind a boat or behind a cable. Because a boat is not needed for cable-wakeboarding, its popularity has increased. First the case will be described, and then the relevant literature will be reviewed.

Case Report
A 35-year-old man presented at the emergency room with severe pain in his left forearm following an accident at the start of the cable-wakeboarding. The patient was still lying deep in the water ready to start, when during the acceleration from the water all of a
sudden his left forearm got strangulated in the cable. The strangulation lasted only for a short time, until the cable was released by the watchman pressing the emergency button.

The swelling of the forearm was progressive and increasingly painful. After 2 h he was presented at our emergency department; the examination of his left forearm showed a severely swollen proximal part of the forearm with a marked hematoma (Figure 1). The patient held his arm flexed in the elbow, with his hand up. The skin showed strangulation marks of the robe but it was intact, probably due the protective wet suit that he had been wearing at the time of the accident. On examination the arm was very tender to palpation. The pain increased with passive stretching of the fingers. Radial pulses were intact. The radial part of the thumb showed sensory loss.

Because a compartment syndrome was suspected the patient was taken to the operating room. No intracompartmental pressures were measured. A fasciotomy with a volar (Henry’s approach) and dorsal incision was performed (Figure 2). With opening of the fascia a large hematoma was evacuated from both compartments. The dorsal compartment showed confusion of the extensor muscles. The volar compartment showed an intact biceps and brachioradialis, but a complete disruption of the flexor digitorum muscle was seen at exactly the same spot where the strangulation marks were seen on the skin (Figure 3). The hematoma was removed, but it was impossible to repair the muscle injury. The wound was left open. After 3 days a second operation was performed, wherein a vessel loop system was applied for dermatotraction (= progressive skin traction). After 4 days, this was removed and delayed primary skin closure (with staples) was partially performed (Figure 4). The rest of the wound was treated partially with an alginate dressing (Kaltostat®, Convatec, Woerden, The Netherlands) and with a nonadherent dressing (Adaptic®, Johnson and John-