

# Fracture of Vertebra D12 in Jet-Ski accidents

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The recreational use of personal watercraft (jet-ski) has grown in the last two decades, bringing with it increased risk of injury to both riders and swimmers. According to the Ministry of Transport & Road Safety in Israel, the number of small watercraft in Israel doubled during the years 1999–2007. Several mechanisms of injury have been described in accidents involving such watercraft [1-3]. We present here two cases of spine injury that were admitted to our department, one week apart, at the start of the water-sports season.

## PATIENT DESCRIPTIONS

A 61 year old man fell and injured his back while riding his jet-ski. He was admitted to the emergency department and a complete trauma workup was performed. He was hemodynamically stable with no chest or visceral injury. His lower back and pelvis were tender to percussion. The pelvis was stable and there were no neurological findings. Imaging studies showed compression fracture of the D12 vertebra, right superior and inferior ramus pubis and right sacrum fracture. On computed tomography of the lower back, sacrum and hip joints, fracture of D12 was diagnosed as incomplete burst fracture without protrusion to the spinal canal (AO A3.1). The injury was considered mechanically stable and the

patient was treated non-operatively with analgesics and limited activity under the supervision of a physiotherapist. He was discharged home 8 days after his admission.

The second case was a 40 year old man who complained of a severe backache after "jumping waves" with his jet-ski and landing hard on the water. He had no other complaints. On complete trauma workup that was performed in the emergency department, the only finding was tenderness to percussion on his lower back. Imaging studies revealed an unstable burst fracture of D12 (AO A3.2) with 40% protrusion to the spinal canal and 23° kyphosis [Figure]. Since the fracture was considered mechanically unstable, surgery was recommended to prevent future structural or neurological deterioration. One day after his admission, a corpectomy of D12 and anterior fusion of D11-L1 vertebrae were performed via

a left postero-lateral approach. This was followed by decompression of the spinal canal and implantation of a metal cage and autologous bone graft in the place of the D12 vertebra. This approach was selected because of the combination of anterior column height loss and canal protrusion. We felt that regular posterior fusion would not provide a suitable solution for this patient. It should be emphasized that both approaches are appropriate in such a case. The postoperative period was uneventful, and the patient was discharged home 8 days after surgery.

## COMMENT

Among the mechanisms of injury in jet-ski accidents are direct collision, fall from the watercraft, handlebar straddle injuries, axial loading, and hydrostatic injuries [1-3]. These accidents can result in injuries to the head and face, spine,



Sagittal CT reconstruction of the thoracolumbar spine of patient 2, showing complete burst fracture of D12 (AO A3.2) with kyphosis and penetration to the spinal canal.

extremities, pelvis and visceral organs. The percentage of serious injuries and the fatality rate are high compared to other water sports and are attributed mostly to drowning and blunt trauma (70% injuries, 2%–3% fatalities) [1]. Spinal burst fractures, which are typically related to axial loading, are usually located in the thoraco-lumbar transitional area. Fractures of that kind can also occur in the cervical spine. The thoraco-lumbar junction area is more vulnerable to injury than other adjacent portions of the spine. Approximately 50% of all vertebral body fractures and 40% of all spinal cord injuries occur between D11 and L2. This greater susceptibility to injury can be explained by the anatomic changes in this area (such as decrease in rib restraint, changes in stiffness for flexion extension and rotation, and changes in disk size and shape) that occur acutely in the transitional area between the upper thoracic and the mid-lumbar spine. The normal thoracic kyphosis creates anterior flexion load on the vertebral body and results in burst fracture in the vertebrae.

The Denis classification system uses the three-column concept, categorizing fractures into four minor and four major injuries. Burst fractures are one of the four major injuries and involve at least two columns and, therefore, are considered unstable according to the Denis criteria.

Jet-ski injuries should be managed in the emergency department where a complete trauma workup can be carried

out. The mechanism of injury should alert the physician to the possibility of spinal column injury and instability, and spinal injury precautions are crucial until a complete evaluation can be performed. Lack of neurological symptoms or signs is not enough for clearance of the spine, since an unstable fracture can appear in up to 40% of neurologically intact patients. The decision whether to treat operatively or non-operatively depends on the type of fracture, the inherent mechanical stability of the fracture, and the presence of neurological deficit.

A study by Carmel et al. in Israel [5] described eight spinal injuries related to jet-ski accidents between the years 1995 and 1999. The fractures were of burst or compression type involving the anterior column with or without the middle column, a characteristic injury resulting from flexion compression. All cases were treated non-operatively. The authors suggested that since those injuries were caused by sudden deceleration when landing on water from the height of the wave they can be referred to as wave-jumping injury. The authors also discussed the low waves and relatively obstacle-free Mediterranean Sea shores as compared with the high wave amplitude and crowdedness of the shores abroad.

In the two cases presented here, the type and mechanism of injury resemble those reported elsewhere as an axial load while wave jumping, and not as described by Carmel et al. [5] as a deceleration injury.

This shift in injury mechanism of jet-ski accidents, in our opinion, is due to the increasing power of these vehicles and the ability to reach greater heights with lower wave levels. As already reported by Shatz and colleagues [4], injury mechanisms at lower wave levels, as found in lakes, were similar to those in open waters.

In conclusion, the attending physician in the emergency department should have a high index of suspicion for spinal injuries in jet-ski riders, which can be caused by a direct hit or from wave jumping with an axial load mechanism comparable to a fall from a height.

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