

Cervical Spine Injuries in Fayed Resort: Shallow Water Accidents

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Abstract

Background Data: Shallow-water diving injuries have devastating consequences for patients and their families in terms of requiring intensive use of resources in both the acute and rehabilitative phases of injury. With the final clinical outcome often poor, the question is raised as to whether a target group can be identified for whom to implement a preventive program.

Purpose: Our aim is to evaluate the demographics, clinical features and outcomes of shallow-water diving injuries in Fayed resort.

Study Design: A descriptive analytic cross section prospective study involving 20 patients with diving accidents.

Patients and Methods: During the period from January 2011 to May 2014, 20 patients who presented with diving accidents from Fayed city were surgically treated in Suez Canal University Hospital in the Neurosurgery Department. Initial treatment was made according to Advanced Trauma Life Support guidelines, followed by neurological and radiological examination to determine the severity of the injury. Neurological classification was made according to the American Spinal Injury Association/International Medical Society of Paraplegia Impairment scale. Cervical traction was used in cases of subluxation. Surgery was performed in cases of spinal instability or cord compression.

Results: Neurologically, eight patients had complete ASIA, grade A, spinal cord injury, eight had incomplete spinal cord injury ASIA grade B (1 patient), grade C (3 patients), grade D (4 patients). The other 4 were normal ASIA, grade E. Five patients presented with teardrop fractures, five burst fractures, eight patients presented with flexion distraction injury including five with bilateral locked facets and three unilateral locked facets and two presented with fracture of the posterior elements. Surgical fusion was done in sixteen patients including anterior approach in fourteen patients and combined anterior and posterior approach in two patients. No neurological deterioration was recorded. Overall, 30% (6/20) patients improved neurologically during hospitalization with regard to the ASIA Impairment Scale.

Conclusion: A very specific patient profile was identified, and the severity of shallow-water diving injuries was confirmed. These data should be used to motivate further educational and preventive programs for reducing the incidence of diving-related injuries. (2014ESJ087)

Key Words: Central cord syndrome, cervical spine injuries, Water-activity-related injuries, diving accidents.

Introduction

Spine injuries are most commonly caused by motor vehicle accidents, falls, and violence. However, spine injuries can also result from accidents that occur during recreational activities. One group of these activities is performed in the water (sea, lakes, rivers, pools, etc.). Different kinds of aquatic spine injuries are secondary to diving, surfing, or waterskiing accidents.^{1,3,4,6-8, 14}

The most common spine injury associated with aquatic activities reported in the literature is caused by diving into shallow waters. Emergency physicians and spine surgeons who practice in beach areas have probably seen the uncommon case of patients who were playing or swimming in the sea and then became quadriplegic after reckless diving in water thus presented with cervical spine injuries. There are few reports in the medical literature concerning spine injuries in shallow water.^{1,3}

Fayed city is one of the most important tourist cities in Egypt. It overlooks the Bitter Lakes that connects both ends of the Suez Canal beaches. It has dozens of private beaches and wonderful tourist villages. The depth of water in Fayed beaches is shallow even distance from the edge of the beach. Many platforms to jump extend distance into water in many of the city tourist villages.

The aim of this study was to analyze main features and outcomes of diving accidents, accepted in our service from Fayed resort in the last five years.

Patients and Methods

The aim of this study was to analyze main features and outcomes of diving accidents, accepted in our service from Fayed resort in the last five years. Items include age and gender, type and level of cervical lesion, associated injuries, neurological status on admission and discharge, treatment, length of hospitalization and complications during treatment, cervical deformity following the vertebral lesion, and rehabilitation.

During the period from January 2011 to May 2014, 20 patients who presented with cervical spine injuries secondary to diving accidents from Fayed city were surgically treated in Suez Canal University Hospital in the Neurosurgery Department. This study was undertaken in relation to diving accidents that took place in Fayed city, a tourist destination with

shallow canal water and many platforms to jump in shallow water of the Suez Canal lakes close to the shore. Only patients who presented radiological findings of cervical spine fracture or dislocation or neurological deficit were included. The mechanism of accident was almost the same in every patient; they were jumping into the canal water. Most of them hit their head into the sand with compression cervical spine injury.

Initial treatment was made according to Advanced Trauma Life Support guidelines,¹⁰ followed by neurological and radiological examination to determine the severity of the injury. The mechanism of injury was established from clinical information and was correlated with data from imaging studies. Neurological classification was made according to the American Spinal Injury Association/International Medical Society of Paraplegia Impairment scale.⁹ (Table 1) Radiographs and computed tomographic scans were performed depending on the patient's symptoms and clinical findings. Subaxial cervical spine fractures was done according to Allen mechanistic classification.² Patients with neurological deficit or those who needed further evaluation to rule out ligament injury had magnetic resonance imaging. Patients with degenerative changes such as osteophytosis, disc collapse, calcification of posterior longitudinal ligament, and ligamentum flavum hypertrophy with or without secondary spinal stenosis were radiographically classified as having spondylosis. Patients who had neurological findings of spinal cord injury (SCI) were treated with National Acute Spinal Cord Injury Study III methylprednisolone protocol treatment.¹¹ Cervical traction was used in cases of subluxation. Surgery was performed in cases of spinal instability or cord compression.

Results

All patients were men and local tourists. Their ages ranged from 15 to 34 years, with a mean age 24.3 years (Table 2). All spine injuries were located in the lower cervical spine; there were no injuries above third cervical vertebra.

Neurologically, eight patients had complete ASIA grade A spinal cord injury. Eight patients had incomplete spinal cord injury ASIA grade B (1 patient), grade C (3 patients), grade D (4 patients)

(those included central cord syndromes in 6 patients and Brown Sequard syndromes in 2 patients). Four patients were normal ASIA grade E. (Table 1) Four patients presented with associated injuries; two of them presented with a mild head injury with loss of consciousness, and another two presented with near drowning.

Radiographic studies and clinical information suggested different patterns and mechanism of injury including 14 (70%) patients with hyperflexion, four (20%) axial compression, and two (10%) with extension distraction. Five patients presented with teardrop fractures, five with burst fractures, eight patients presented with flexion distraction injury including five with bilateral locked facets and three unilateral locked facets and two presented with fracture of the posterior elements. Of special note is that two (10%) patients presented with initial radiographs without fracture or dislocation, all of whom had CCS (patients No 2 and 11 in table

2). Subaxial cervical spine fracture classification according to Allen mechanistic classification² is presented in table 2.

Attempted closed cervical traction was tried in all the seventeen patient indicated for traction (all the patients in table 1 except patients No 9, 14 and 19). Complete reduction was achieved in fifteen patients and partial reduction was achieved in two patients. Surgical fusion was done in sixteen patients including anterior approach in fourteen patients and combined anterior and posterior approach in two patients.

Neurological Outcome:

No neurological deterioration was recorded. Overall, 30% (6/20) patients improved neurologically during follow up with regard to the ASIA Impairment Scale (AIS). All of which were initially incomplete lesions, and the improvement concerned both the neurological level and the AIS. (Table 1)

Table 1: The American Spinal Injury Association Impairment Scale

Description
A: complete
B: incomplete: sensory but not motor function is preserved below the neurological level and includes the sacral segments S4-S5
C: incomplete: motor function is preserved below the neurological level, and more than half of key muscles below the neurological level have a muscle grade less than 3 strength
D: incomplete: motor function is preserved below the neurological level, and at least half of key muscles below the neurological level have a muscle grade of 3 or more strength
E: normal



Figure 1.
A: Preoperative 34-year-old male sustained diving injury with flexion compression burst fracture C6. B: postoperative follow up plain x-ray cervical spine, with fixation and fusion of C5-C7.

Figure 1. Pre & Postoperative ASIA scoring for outcome in our patients group

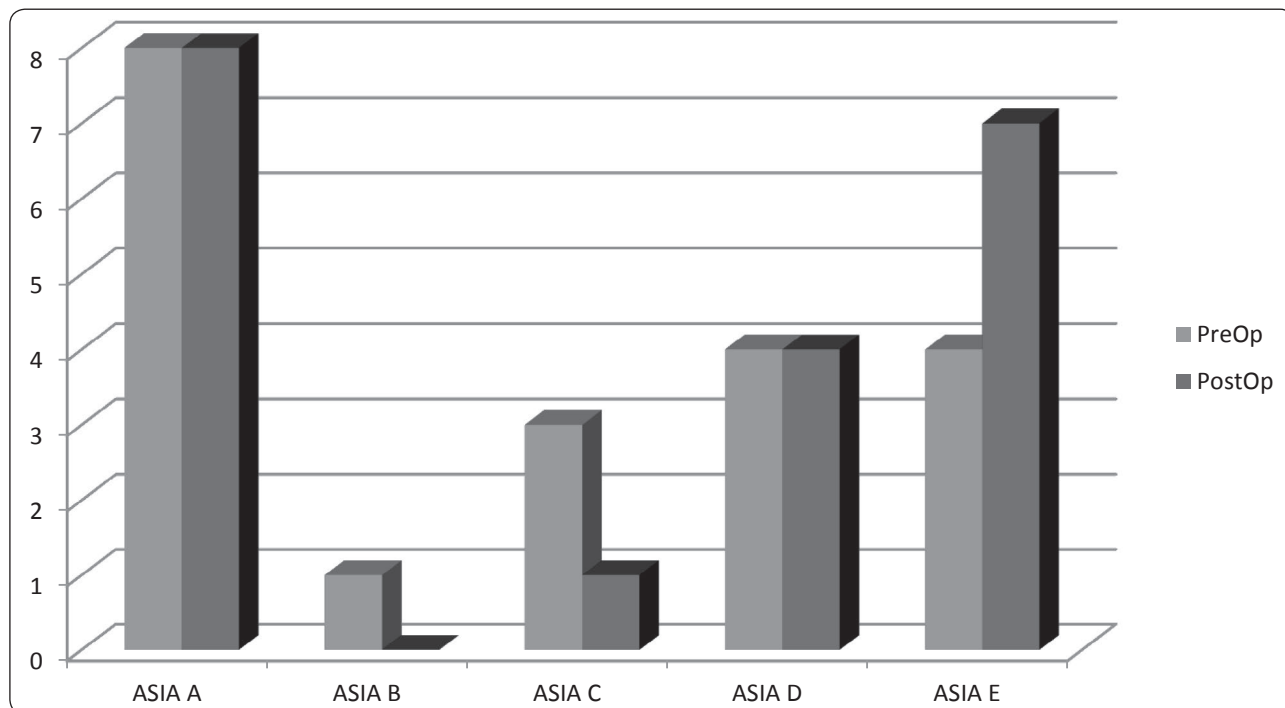


Table 2: Pre-operative Data of the Study Group

Patient No	Age/Sex	Allen Mechanistic Classification ²	Description	Level	Neurology
1	15/M	FC5	Tear drop #	C4-5	Complete cord
2	21/M	FD2	bilateral Locked Facet	C4-5	Central cord syndrome
3	26/M	FC4	Tear drop #	C5	Complete cord
4	18/M	VC3	Burst #	C4	Central cord syndrome
5	29/M	FD3	bilateral Locked Facet	C6-7	Complete cord
6	31/M	FC5	Tear drop #	C5-6	Complete cord
7	27/M	FD3	bilateral Locked Facet	C5-6	Incomplete cord
8	23/M	VC3	Burst #	C5-6	Central cord syndrome
9	17/M	ED	# posterior elements	C6	intact
10	19/M	FD3	bilateral Locked Facet	C5-6	Complete cord
11	27/M	FD2	Unilateral Locked Facet	C5-6	Central cord syndrome
12	32/M	FC5	Tear drop #	C4-5	Complete cord
13	17/M	FD2	Unilateral Locked Facet	C6-7	Central cord syndrome
14	24/M	VC2	Cupping of the Vertebral body	C4	intact
15	34/M	FC3	Burst #	C6	intact
16	21/M	FD3	bilateral Locked Facet	C5-6	Complete cord
17	22/M	FC4	Tear drop #		Complete cord
18	27/M	VC3	Burst #	C5	Central cord syndrome
19	30/M	ED	# posterior elements		intact
20	25/M	FD3	bilateral Locked Facet	C7-1	Incomplete cord

Discussion

Spine trauma in shallow water Canal bathers is a special type of injury that occurs in the cervical spine. It occurs because of the combination of lack of experience in diving in shallow waters. Young patients present the most severe injuries and a diversity of types of lesions. The most common injury in these situations is complete cervical spine secondary to hyperflexion.

Every patient in this report was a male local tourist, probably with little or no experience of diving in the lake. This increases the risk of experiencing this type of injury. Reports of cervical spine injuries related to aquatic activities have been published previously; the most severe and devastating of these injuries is related to diving into shallow waters. Spine injuries caused by diving affect mostly young men, and almost 50% of these cases present with complete spinal cord injury.^{1,3} forty percent of patients in our study suffered complete spinal cord injury.

In these diving-related accidents, patients usually hit their heads into the sand. For this reason, the spine injury occurs in the cervical spine. In the present series, the results show that all of patients were younger than 34 years. The posture of the head and neck at the time of the injury and the location and direction of the force vector will dictate the pattern of cervical spinal injury; the kinetic energy imparted predominantly dictates the magnitude of the injury.⁵ This statement applies in this case series as well. The main mechanism of injury in our series was hyperflexion (70%). This pattern of injury is explained by the fact that most of the patients hit the sea bottom with their vertex. The rest of the patients presented with vertical compression and extension distraction injuries. In a previous study, Cheng et al,⁶ reported an incidence of 78% of a hyperflexion injury mechanism in cervical injured patients secondary to head hitting the bottom of the sea.

This report presents and analyzes a series of patients who experienced a cause of spine injuries that has not previously been described commonly. Diving injuries occurred exclusively in the cervical spine because of the special characteristics of the previously described accident mechanism. The most devastating and severe injuries occurred in young

patients. Young patients presented with tear drop fractures, burst fractures and locked facets.

Conclusion

A very specific patient profile was identified, and the severity of shallow-water diving injuries was confirmed. These data should be used to motivate further educational and preventive programs for reducing the incidence of diving-related

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الملخص العربي

اصابات الفقرات العنقية فى منتج فايد : حوادث المياه الضحلة

المقدمة: تمثل اصابات الغطس فى المياه الضحلة مع اصابة الفقرات العنقيه مشكله كبيره للمرضى و المجتمع خصوصا مع ضعف التحسن الاكلينيكي للاصابات العصبيه الناتجه

الهدف: توضيح الخصائص الاكلينيكيه و النتائج الجراحيه لاصابات الفقرات العنقيه الناتجه عن الغطس فى المياه الضحلة فى مدينة فايد بالاسماعيليه

طريقة الدراسة: دراسة لحالات اكلينيكيه على ٢٠ مريض بكسور الفقرات العنقيه. تم إجراء تقييم تحليلي بأثر رجعي خلال الفترة من يناير ٢٠١١ حتى مايو ٢٠١٥ للنتائج السريرية والإشعاعية لعدد ٢٠ مريض عانوا من كسور الفقرات العنقيه بع الغطس فى المياه وذلك بقسم جراحة المخ و الأعصاب بمستشفى جامعة قناة السويس بالإسماعيلية .

النتائج: عانى ٨ مرضى من اصابه كامله للحبل الشوكى و عانى ٨ مرضى من اصابه جزئيه و ٤ مرضى كانوا بلا اصابات عصبيه . تم اجراء التدخل الجراحى فى ١٦ مريض لتثبيت الفقرات و قد تحسنت حاله العصبيه فى ستة مرضى

الاستنتاج: يجب البدء فى برنامج توعيه لمنع حوادث الغطس و اصابة الفقرات العنقيه الناتجه عنها