"NEUROLOGICAL INJURIES SUSTAINED THROUGH DIVING"

by

Dr. Ludwig Guttmann
Director, National Spinal Injuries Centre

Attention is drawn to the need for school teacher swimming instructors and parents to consider as one of their foremost duties, the education of the young in the safety of diving. Inasmuch as schools try to educate the young in safety on the roads, the same should be applied to the hazards of diving.

The most devastating disability resulting from a severe injury of the spinal cord is that which affects the cervical portion of the cord. An awareness of the anatomical and physiological nature of the cervical cord immediately confirms the magnitude of such a disaster. All the peripheral nerves responsible for the innervation of the muscles of the arms, hands and fingers, and important muscles of the shoulder girdle as well as the main respiratory muscle (the diaphragm) originate from ganglion cells situated in the anterior horns of the eight segments of the cervical cord. Moreover most important long nerve tracts which originate in the brain and connect the brain with all parts of the body, and others which mediate impulses from the various parts of the body to the brain travel through the cervical cord. These tracts are concerned with certain motor functions, and control the equilibrium as well as conduct all modalities of sensation. Furthermore, they control bladder, bowel and sexual functions, as well as blood circulation and temperature regulation of the body.

A person who as a result of fracture or fracture dislocation of the cervical spine is afflicted with a severance or severe spinal cord injury, is instantaneously transformed from a healthy individual into a helpless wreck. He is paralysed in the greater part of the body, involving also the upper limbs. As a result of the paralysis of important respiratory muscles, the intercostals and the abdominals, his respiration is already precarious in injuries below the 5th cervical segment in spite of the function of the diaphragm, which is preserved in these mid cervical lesions. If this respiratory muscle is also involved in injuries involving the 5th and 4th cervical segments, respiration depends on auxilliary muscles, such as the sternomastoids which are quite insufficient, and the patient will die if artificial respiration and tracheotomy is not installed immediately. In the past the prognosis of a tetraplegic or quadriplegic was quite hopeless and these unfortunates died within hours or days.

A profoundly defeatist attitude towards tetraplegics has been apparent throughout the centuries right up to recent years, and in many countries this is so today. Advances made in the treatment and rehabilitation of patients with spinal cord injuries made during the last twenty years have also changed considerably the prognosis of tetraplegics. Consequently there is no doubt that the number of tetraplegics who survive is increasing continuously, and therefore this is becoming not only a medical problem but also a social one of steadily increasing importance.

Attention is drawn to the fact that, amongst the causes of traumatic tetraplegia, Sports injuries which number 110 are the second highest and take second place only to road accidents which make a total of 142 (see table). The great majority of these injuries (81) are due to water sports, and of these no less than 74 are due to diving. These represent nearly three-quarters of all Sports Injuries. The tragedy is that the victims are usually in the prime of their adult life.

Circumstances in which diving accidents occurred are classified as follows:-

1. The majority were sustained through diving into shallow water mainly in rivers but also into the sea and ordinary swimming pools. The divers strike their heads against hard surfaces which may be sand, rock or concrete, or against metal bars, the diver being in a position of extension or flexion. The height from which the dive was made causing the injury was found to be unimportant.
2. In a few instances a diver has hit another swimmer who has been above the water, and in one instance a man diving from a 12ft board hit another swimmer who was under the water, the diver receiving the injury. Three divers had sustained tetraplegia by hitting the water in the swimming pool with the head at the wrong angle; this has happened in the case of experienced as well as novice divers.

Swimmers in the sea can be hit by diving into strong waves. This is more common in countries where surf riding is popular.

First aid

In treatment the people who give first aid must be familiar with the first aid management of traumatic tetraplegics. The most important measure is to prevent further damage to the spinal cord by wrong handling of the head. The head should be kept in a neutral position and any bending backwards or forwards must be avoided at all costs. Therefore the person responsible for holding the head has to be particularly careful in this respect. Once taken out of the water the patient can

lie in a supine position, unless he is unconscious in which case he must lie in a lateral position, and a pillow should be placed under the small of the back and a small support under the neck. The patient should be covered with blankets, for in the early stages of tetraplegia the thermo-regulation is completely knocked out and the patient is poikilthermic, i.e. with a thermo-regulation like that of a reptile. Under no circumstances must hot water bottles be used on any part of the body, as such a patient will develop burns immediately. The tetraplegic must be lifted on to a stretcher by four people, and meticulous care must be taken by the person who is holding the patient's head.

The most important measure in diminishing these dreadful injuries is prevention, and here too much emphasis cannot be paid to the education of the public generally. Everything possible should be done to prevent and diminish the number of victims of these frightful accidents.

Schools try to educate the young in the safety of the roads - so too should they educate the young in respect of the hazards of diving. This should be one of the foremost duties of Schoolteachers, Swimming Instructors and parents.

**Table of Injuries used by Dr. Guttman to illustrate
incidence of tetraplegia sustained in various activities**

	<u>Complete Lesions</u>				<u>Incomplete Lesions</u>		
	<u>Living</u>	<u>Dead</u>	<u>Total:</u>		<u>Living</u>	<u>Dead</u>	<u>Total</u>
<u>Road Accidents</u>							
Motor Vehicle	28	14	42 :		82	10	92
Motor Cycle	16	5	21 :		20	1	21
Pedal Cycle	1	2	3 :		19	1	20
Hit by Vehicle	2	-	2 :		9	-	9
<u>Industrial Accidents</u>							
Fall	7	2	9 :		10	3	13
Hit by moving object	2	-	2 :		12	2	14
Caught in moving machinery and other objects	1	-	1 :		2	-	2
<u>Sport</u>							
Diving	27	3	30 :		39	3	42
Struck by Diver	-	-	- :		3	-	3
Swimming other than diving	1	-	1 :		5	-	5
Rugby	3	3	3 :		3	-	3
Soccer	-	-	- :		3	-	3
Riding	1	1	2 :		1	1	2
Climbing	1	-	1 :		-	-	-
Wrestling	-	-	- :		1	-	1
<u>Gymnastics</u>							
Trampolining	1	-	1 :				
Other: vault horse etc.	4	1	5 :		8	-	8