



The International Marine
Contractors Association

Notes Accompanying the IMCA DVD **Neurological Assessment of a Diver**



The International Marine Contractors Association (IMCA) is the international trade association representing offshore, marine and underwater engineering companies.

IMCA promotes improvements in quality, health, safety, environmental and technical standards through the publication of information notes, codes of practice and by other appropriate means.

Members are self-regulating through the adoption of IMCA guidelines as appropriate. They commit to act as responsible members by following relevant guidelines and being willing to be audited against compliance with them by their clients.

There are two core activities that relate to all members:

- ◆ Safety, Environment & Legislation
- ◆ Training, Certification & Personnel Competence

The Association is organised through four distinct divisions, each covering a specific area of members' interests: Diving, Marine, Offshore Survey, Remote Systems & ROV.

There are also four regional sections which facilitate work on issues affecting members in their local geographic area – Americas Deepwater, Asia-Pacific, Europe & Africa and Middle East & India.

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This DVD and accompanying notes have been produced for IMCA, under the direction of its Diving Division Management Committee, by Bob Gardiner of Buckingham Human Factors, with filming and editing undertaken by Mr Kenny Thomson.

www.imca-int.com/diving

The information contained herein is given for guidance only and endeavours to reflect best industry practice. For the avoidance of doubt no legal liability shall attach to any guidance and/or recommendation and/or statement herein contained.

1 Introduction

The neurological state of a diver is important for medical personnel in determining the diagnosis of an injured diver and as a guide to treatment. Life support personnel and diving supervisory staff will also benefit from the results of a neurological assessment in determining treatment protocols should medical advice be unavailable. Many neurological tests are quite easily performed and can be carried out by those who have no medical experience.

Treatment by pressure and breathing oxygen, where indicated, should not be delayed by neurological tests. The tests should be repeated periodically at depth and after surfacing.

When assessing the neurological state of the patient, initially examine the areas where symptoms are described so that early information can be transmitted to the medical personnel. Once this has been carried out then conduct a systematic test of motor, sensory and co-ordination function.

The results of an assessment must be recorded accurately for communication and to confirm that the appropriate procedures have been completed.

2 Communicating Information

One of the most essential components of the efficient handling of emergencies is good communications. Many factors can cause important information to be lost, such as poor equipment, helium speech, stress which causes rapid speech, infrequently used medical terminology, the passing of incorrect information and language difficulties, including the use of heavy accents. Those dealing with the situation should speak clearly and precisely. If there is any doubt, there should be clarification.

3 Introduction to Video

The video shows some basic tests that every diver should be confident in being able to perform competently when needed. There are many other tests that a doctor could request and often several different ways of performing them. In the interests of being able to use and interpret standardised procedures world-wide, this guidance is based on the examination detailed in the US Navy Diving Manual:

<http://www.diverlink.com/library/usn/Chap5a.pdf>

4 Mental Status

Is the patient fully alert and orientated, confused, drowsy, unconscious but responding to stimuli or unconscious and unresponsive? Be alert for changes in consciousness, not just increasing drowsiness, but also agitation. You can assess this whilst taking the history of the dive from the patient. The responses to questions will point towards the mental status. Other indicators are memory changes, orientation and mood. Is his mood normal (taking into account the circumstances)? Does the diver:

- ◆ know where he is,
- ◆ what day it is, etc.?
- ◆ his/her own name and age?
- ◆ know the diving supervisor's name?
- ◆ know what he had for his previous meal?

Listen to the diver's speech. Note misplaced, inappropriate words and incorrect word order, or signs of confusion.

Test mental ability by asking the diver to subtract 7 from 100, then 7 from the answer and so on. If an error is repeated, such as "93, 90, 83, 73, 60", this is called preservation and usually indicates impairment.

5 Co-ordination

5.1 Walking

Watching someone walk is a good indicator of muscle strength and general coordination. If a diver walks normally it indicates that general brain function is good. If the patient limps, drags a foot or staggers, these are signs that need to be reported. A closer inspection of coordination is to see if the patient can walk heel-to-toe along a straight line? (These tests can sometimes be difficult because the vessel may be moving too much).

5.2 Balance (Romberg Test)

Have the diver stand straight, feet together, arms extended to the front, palms up and eyes closed. Note if balance is normal or not. Give the patient a small shove from either side with the fingertips and note whether the patient can maintain his balance or if he immediately falls to one side. Be prepared to support him if he falls.

5.3 Rapid Alternating Movement

With the rapid alternating movement test, the patient slaps one hand on the palm of the other, alternating palm up and then palm down. Note that, in normal conditions, people will be able to carry out this test faster with their dominant hand.

5.4 Finger-to-Nose Test

Can the diver move a finger from touching your finger to the tip of his nose and repeat the motion? The examiner will change the position of his fingertip each time the patient touches his nose. In this version, speed is not important, but accuracy is. Also, the patient stands with eyes closed and head back, arms extended to the side. Bending the arm at the elbow, the patient touches his nose with an extended forefinger, alternating arms. Be prepared to support him if he falls.

5.5 Heel-Shin Slide Test

While standing, the patient touches the heel of one foot to the knee of the opposite leg, foot pointing forward. While maintaining this contact, he runs his heel down the shin to the ankle. Each leg should be tested. Be prepared to support him if he falls. If necessary this test can also be done when lying flat.

5.6 Cranial Nerves

There are pairs of nerves that mainly arise in the lower part of the brain which emerge from the cranial cavity through various openings in the skull; these are called the "twelve cranial nerves". Abnormal responses when testing this group can tell the doctor where a lesion may have occurred.

5.7 Smell

The sense of smell is controlled by the olfactory nerves. It is seldom tested. However, if it is requested by a physician, test with coffee, one nostril at a time? Note that some people lose their sense of smell in a Heliox environment so this may not be conclusive.

5.8 Eyes

In all these tests, check for imbalance, irregularity, poor reactions, etc. Vision/sight (optic nerves) can be tested by measures such as holding up two fingers for patient to count, asking him to read. The field of vision can also be tested. The video demonstrates this test. Also, note if the patient reports any distortion or loss of vision.

For eye movement (occulomotor, trochlea and abducens nerves) have patient follow with his eyes as you move your finger up and down, left to right and then into the nose giving the 'cross-eyed' look. Check that he follows your finger easily. If movement fails in one direction note which one.

The pupils are easily tested. Look for constriction, dilation, equal size and reaction, etc. Are the pupils equal and normal in response to light? If a light is shone into one eye, the pupil in the other eye will constrict. Is the corneal (blink) reflex normal?

Has he any visual disturbance? Ask the patient if he has any blurring of vision, loss of vision, spots in the visual field, or peripheral vision loss (tunnel vision).

Does the patient have nystagmus? Ask the patient to follow the movement of a finger from a central position to the external left and right without head movement. Nystagmus is a flickering movement of the eyes, a fast movement and a slow return towards the initial position. It occurs looking left or right or up and down.

5.9 Head

The trigeminal nerves govern sensation of the forehead and face and the clenching of the jaw. The facial nerves control the face muscles. They stimulate the scalp, forehead, eyelids, muscles of facial expression, cheeks, and jaw. Sensation is tested by lightly stroking the forehead, face, and jaw on each side with a finger or wisp of cotton wool. Check for the symmetry of the mouth in the resting position, smiling normally then grimacing to show the teeth, sticking out the tongue and shutting the eyes tightly. The two sides should perform symmetrically.

Does he talk satisfactorily and can he say "Aahh" satisfactorily (glossopharyngeal and vagus nerves) or is there any gagging, hoarseness or poor enunciation? Can he stick his tongue straight out (hypoglossal nerves)? An injury to one of these nerves will cause the tongue to go to one side.

5.10 Shoulders

Can he shrug his shoulders equally (accessory nerves)? This nerve can also be tested by seeing if the patient can turn his head equally to left and right against resistance (e.g. the examiner's hand).

5.11 Hearing

The acoustic nerves control hearing and balance. They can be tested using a number of methods, but can be difficult due to background noises, such as noisy machinery. If in doubt, get the equipment turned off briefly. Ideally, whisper approximately 2m away from the ear. Can he hear? Other methods include rubbing your fingers together next to the patient's ears or using a tuning fork. Compare each ear.

6 Skin Sensitivity (Sensory Nerves)

Patients may complain of numbness, discomfort - usually paraesthesia (tingling/'pins and needles') or pain in any area of the body. This may be caused by decompression illness affecting the spinal cord. To check for effected areas test the ability to discriminate between sharp and blunt pressure to the skin. Usually, this is carried out over the limbs as seen in the video but a doctor may require a more extensive test. Do not use a hypodermic needle for these tests as the skin can be broken quite easily.

If an area of abnormality is found, mark the area because, during treatment, these areas are rechecked to determine whether the area is improving. An example of improvement is an area of numbness getting smaller.

7 Extremity Strength (Motor Nerves)

A common effect of decompression illness is muscle weakness. This can be checked by measuring strength of various muscle groups. Check normal movement of both legs and arms.

There are many tests that can be carried out with all limb muscle groups and the doctor may ask for a number of these to be carried out. The simplest form is to have patient grip two of your fingers with each hand. Is the strength in each hand the same? Ask him to push you away and then pull towards him. When the patient is lying down, place your hands on his knees, just above the knee, and press down lightly. Have him try to bend his knee. Is the strength equal in each?

The above will detect weakness or paralysis in muscles but other symptoms such as twitching of a muscle should also be noted.

8 Reflexes

Checking the reflexes is carried out in order to determine if there are any noticeable differences between the deep tendon reflexes. In some parts of the world reflexes are tested before diving starts and these records can be compared. Alternatively, data from annual diving medical examination can be used for comparison. If neither these are available then the examiner can report whether there are any difference between the sides and note whether the response is normal, nonexistent, hypoactive (deficient), or hyperactive (excessive).

The most common reflexes to be tested are the knee and elbow. The doctor may require others such as at the ankle, wrist, jaw and abdomen. (Scratching the abdomen vertically on the left and right sides at the end of expiration should cause a slight contraction of the abdominal muscles).

There is also the Babinski reflex. This entails running a blunt object up the sole of the foot from heel to the base of the large toe. If the foot curls downward this is satisfactory. If the toes curl backwards (dorsiflexion) this is a reliable sign of neurological decompression illness.

Checking reflexes is not easy to carry out in normal circumstances. In an emergency it is difficult. It is recommended that these are practised when possible.

9 General

Note any other symptoms like headache or an inability to tolerate strong light.

Does the patient have vertigo (dizziness), etc?

Can he pass urine?

10 Equipment Needed

Torch (for eye pupil tests)

Cotton wool or tissue paper (for light touch)

Paper clip (one end unbent. For sharp or blunt discrimination test)

Patella hammer (for reflexes)

Tuning fork (is useful for testing hearing as is different from background sounds)

11 References

DMAC 01 Aide Mémoire for Recording and Transmission of Medical Data to Shore

USN Diving Manual 5A-3 Neurological Assessment.

These notes accompany the IMCA video “*Neurological Assessment of a Diver*” (IMCA D 036, April 2005).