# DECOMPRESSION SICKNESS:

# TWO CAUTIONARY TALES

C Gordon Daugherty

These two cases involve commercial divers, the group of divers with which most of my work is concerned. They illustrate important points of general applicability as well as showing how serious problems can evolve and affect even trained and experienced personnel when correct procedures are not followed.

## Case 1

A dive was planned to a depth of 330 feet to inspect a valve. The diver was to be tended from a bell 50 feet shallower by a second diver, the bellman. At the start of the dive, the diver was lowered to 230 feet but the bellmen, upon entering the water, developed a communication problem and was returned to the surface to change helmets. After a period of ten minutes, the diver was also returned to the surface, then both men were lowered to the bottom after the communication problem was corrected. Bottom time was uneventful. The diver noticed pain in his left elbow as he was leaving his first stop at 170 feet. During the remainder of decompression in the water, pains developed in the other extremities also. These pains tended to improve during each stop, only to become worse as the diver travelled to the next stop. This pain was not reported to topside personnel.

Upon reaching the surface, the pain was sufficient to cause the diver to have difficulty climbing the ladder. During surface decompression on oxygen, the pain continued, primarily in the elbows. At the end of routine decompression, the diver left the chamber momentarily, then re-entered and received US Navy Table 5. This apparently relieved all pain, but at the end of treatment, the diver noted that he was extremely fatigued and went below to his bunk where he slept for five hours. Upon awakening, he again noted marked pain in all extremities and was treated with a US Navy Table 6, with one extension at 60 feet. During this treatment, all pains were relieved except the most severe pain in the left shoulder. No further treatment was given. The diver remained at the dive site for one additional day, doing minor chores. The pain in the left shoulder persisted and continued to be very noticeable. He did no further diving.

On the second day following his accident, he returned to shore and then drove to his company's office in the next state. There further treatment was administered with satisfactory resolution of the problem.

This case is almost a catalogue of errors. The diver should have been returned to the surface promptly when the bellmen developed difficulty with the microphone in his helmet. Failing this, the ten minute bottom time for the first "dive" should have been figured into the decompression of the actual dive, but this was not done.

The situation of bends symptoms developing while still in the water is an entire subject in itself. Suffice it to say that there are various strategies which might have been attempted, though there is no official method. Nothing was done because of the diver's failure to report the symptoms, allowing them to become worse as decompression continued.

Use of Table 5 was inappropriate, as symptoms under pressure are considered serious and a Table 6, probably with both extensions, would have been correct. Upon completion of the inappropriate Table, the presence of extreme fatigue should have been recognized as a possible sign of inadequate treatment.

Leaving the chamber area to go below and sleep was an additional error, as it is customary for a treated diver to remain the chamber area for at least one hour after treatment.

Failure to relieve all pain with the Table 6 which was given after the diver awakened should have been recognized as a definite sign of inadequate treatment. At the very least, advice should have been obtained from the company physician on shore who might have recommended additional treatment. After a further delay of two days, the final treatments that were given relieved all but a very small amount of residual pain in the shoulder which subsided over a period of about four days.

This case also illustrates that often the first error leads to a second which starts a chain reaction, with each error compounding the next. This is certainly not unique to diving but reminds us (in any field) that the best way to deal with a mistake is to do so early.

## Case 2

During a slack period, two commercial divers decided to go spear fishing below the rig where they were working. They were wearing helmets and breathing surface-supplied air, but did not take bailout bottles. They were lowered on a stage to 160 feet, where, after ten minutes, the air supply was suddenly interrupted to both divers. One diver immediately removed his helmet and began a free ascent. The second diver notified the surface that they were out of air, then also removed his helmet and started up. Both divers made their ascent by pulling themselves hand over hand up the line connected to the stage. At some point personnel at the surface began to pull up the stage also.

At the surface, the first diver vomited some sea water. The second soon began to notice weakness in both legs. Both men were treated on a US Navy Table 5. Following completion of this Table, both divers appeared normal and the first diver did well from then on. The second diver was observed for a period of three or four hours, and then was sent to shore.

That evening, he noted tingling in his right leg, but did nothing. Three hours later on, he arose from bed but immediately fell to the floor because of profound weakness in both legs. He was taken to a chamber elsewhere, a trip

which required two hours. About midnight he was recompressed on a US Navy Table 6A. Improvement was noted initially, but the patient's condition deteriorated each time movement to a shallower depth was attempted. The remainder of the night was passed in this fashion, attempting to get the patient to the surface. Apparently no precise Table was followed, although those at the scene attempted to stay as close as possible to Table 6A. At 10:00 the following morning, the patient was at 30 feet in the chamber and was seen by a physician. Urinary retention and constipation were noted. The patient's bladder was catheterized. Upon completion of treatment the patient still had weakness in both legs, urinary retention, and constipation.

If a more detailed neurological examination was performed, it was not recorded. Treatment with a US Navy Table 5 was begun twice daily and continued for nine days, when treatment was stopped because of pulmonary oxygen toxicity. By then the patient had regained some bladder function and his constipation was improved. But there was marked weakness and spasticity of both legs, and impotence. The patient was later sent to a rehabilitation institute for further care and his final neurological status is not known.

A cruel irony in this case is that two professional divers did not observe an ordinary precaution while diving for sport that would have been routine had they been working. I refer to the bailout bottles which were left at the surface while they were spear fishing. Weakness in both legs, a symptom of spinal cord decompression sickness, should be treated by Table 6, not Table 5. Aggressive treatment at the first recompression might have avoided all further problems.

Note the variability of decompression sickness. Given the same exposure and inadequate treatment, one diver did well and one did not.

Although it was prudent to observe the diver for four hours on the rig before sending him to the shore, in a case involving spinal symptoms, plans for possible further treatment could have been considered ahead of time. The diver himself ignored the earliest signs of recurrence, wasting precious time, which was added to the delay of the two hour trip to the chamber.

The most poignant aspect of the case is the desperation of those trying to help the injured diver, not knowing what to do when their chosen Table proved inadequate. In a properly equipped chaser, a diver exhibiting this deterioration would be returned to the depth of relief, held for a period of hours, then decompressed on a saturation schedule. This was not possible in this case.

DISCUSSION

With a diver exhibiting relief at 165 feet, yet deteriorating after the initial bottom time on a Table 6A, a US Navy Table 4 could be used, giving a longer bottom time. This Table could have then been followed to a depth of 60 feet, at which point a Table 6 could have been substituted, ideally with extensions at both 60 and 30 feet. Another alternative which has been successful is to use a US Navy Extreme Exposure Table (or equivalent) for the decompression from 165 to 60 feet. Probably best of all (in my opinion) is the Royal Navy Table 71 or 72 to 60 feet, because of the linear decompression.

If saturation decompression is not possible, and one is running completely out of bottom time on any sort of Table, probably some form of deterioration can be accepted during travel from 165 to 60 feet, in the hope that this would then be corrected by the large amounts of oxygen given from that point on. There is a limit to what can be done simply with depth. Once one has reached the level of 60 feet or less, long holds are possible.

For a more detailed discussion of this problem I refer readers to the article, '"Handling a Tough Treatment Without a Sat System", by RW Hamilton, PhD. Reprints of this article may be available from the Commercial Diving Journal, 1799 Stumpf Boulevard, Building 7, Suite 4, Gretna, Louisiana, USA, 70053. Alternatively, write to Dr Hamilton at: 80 Grove Street, Tarrytown, New York, USA 10591.

*Dr Daugherty has offered to answer questions or enter into discussion concerning these cases if contacted through the Editor.*

## THE PIG, THE OWL AND THE PUSSYCAT

### *A Fable of Simplicity and Self Reliance*

Nigel Froome

There was once a pig (a very bumptious, obese and arrogant pig), an owl (a very wise, sensible and responsible owl), and a pussycat (a very beautiful, charming but naive pussycat) who chanced to meet on a tropical island where they had gone for their diving holiday. One sparkling morning they put to sea in a boat (a beautiful pea-green boat, no less) and headed out to an exotic offshore reef. On the way they chatted excitedly about their past deeds and experiences ... except the owl who listened and winced occasionally at some of the more bombastic statements, especially those of the pig.

"You don't have to worry about me because I'm an experienced instructor," boomed the pig, "and I always insist that my pupils use the very latest in the way of equipment. I sell it in my diveshop you know". He paused to light a cigarette, flicking the still smouldering match into the bilge.

"My instructor made me buy all the latest equipment too," said the pussycat, "and it was very expensive so it must be good! He made us spend hours in the classroom learning all about the theory and techniques of diving, and we had to learn by heart the laws of Henry, Boyle and Dalton and the decompression tables too. We spent more time in the classroom than we did in the water!"