

Spinal Bends: a Case and Some Comments

George F Bond, MD

This case is presented in the form of a letter and reply, as that is the way it was.

Dear Dr Bond

I have read about your pioneer advanced in underwater technology and the formation of the Institute of Diving. I hope that you might be of benefit to me, or at least point me in the right direction. In April my wife suffered decompression sickness with injuries to the spinal cord in the C5 and L4, and possible S4-5 area. This was while we were diving in West Palm Beach, Florida.

The dive was maximum depth of 80 feet, average depth being 70 feet, bottom time was 30 minutes. This was the first dive of the day and following the injury my wife went through three hyperbaric oxygen treatments totally some 19 hours. She is showing gradual and sustained improvement in her neurologic deficits at this time. However, I am extremely interested in pursuing the etiology of this for our personal satisfaction as well as the possibility that it might be of assistance to another sport diver in preventing this tragedy. My wife is 37 and was in excellent physical health, playing tennis five days a week and running some three to five miles a week. Following her recompression, she has been worked up extensively with a barrage of lab work, spinal taps and computerised head and body scans, all of which have been within normal limits.

One of the main questions is why this happened, since we were well within the Navy tables, we were diving with a dive master, and there were no infractions of diving rules. In addition to wondering about the etiology there is the question whether it would be safe (or even advisable) for her to dive again since she did receive multiple injuries from the decompression illness the first time. This was not her first dive to 80 feet, not the hardest or most dangerous as far as decompression illness is concerned. She was examined by two internists who have had training in hyperbaric medicine, but both of us would like her to be evaluated by a professional who specialises in hyperbaric medicine with extensive knowledge in decompression sickness. I would appreciate it if you could assist me with this task.

Sincerely
"ABC", MD

Dear Doctor C

It is always disturbing to hear of yet another spinal cord "hit" following a routine and well executed sports dive. I wish that I could call it a one in a million occurrence in the list book of decompression casualties, but such is simply not the case, which underscores our meagre knowledge of the etiology of bends involving the spinal cord. Let me elaborate on this a bit.

Firstly, about twenty percent of spinal cord "hits" follow clean, non-repetitive dives. Depth does not seem to be a factor, but in practically every case the dive has approached the no-decompression limits. Characteristically, in the 50-odd cases I've treated, the victim has surfaced in a normal physical state and then, within a surface interval ranging from 20 minutes to 12 hours, has experienced upper lumbar pain which rapidly became girdle-like in character,

simulating most closely the syndrome of Tabes Dorsalis, which we rarely see nowadays in practice. At this point the stricken diver reports that he (or she) must have stressed his or her back during the dive, and proceeds to lie down of deck for relief. Minutes or hours later the victim discovers ill-defined paraesthesias of the lower extremities, and discovers motor paralysis as well. Bladder involvement does not become apparent for some hours.

Physical examination of this typical case reveals an apprehensive patient with quite normal vital signs with respect to all but the spinal cord component of the CNS. Ordinarily, the somatic involvement at lower segments as well. Anterior and posterior horn abnormalities will be noted, in varying degrees of severity. There will be present degrees of flaccid paralysis of the lower extremities, with positive Babinskis, ankle clonus, positive chaddock, absent cremasterics, and weak or absent abdominal reflexes. Position sense is generally absent. In short, we have an instant paraplegic.

The treatment of this dive paraplegic is pretty well established, though through trial practice, not extensive research. US Navy Table 6-A is the primary treatment of choice, since this combines the desiderata of rapid, deep recompression for reduction of bubble size with subsequent oxygen drenching to relieve the hypoxis neural tissue of the spinal cord. This therapeutic protocol may be repeated at suitable intervals, or until the hazard of pulmonary oxygen toxicity becomes too great. On rare occasions after apparent failure of the 6-A therapy one might try Table IV, although very few of us would advocate this final gesture, since it holds virtually no promise, save further physical hazard to the patient thanks to a mandatory 34 to 38 hour stay under pressure. Still, Table IV is in the book, and some would use it in such a case to clear decks in case of future litigation. An added note is in order: all spinal cord "hits" customarily are given a 3-day course of Decadron, to avoid anticipated cord oedema, and such other supportive therapy as may be deemed necessary.

Let us now return to your wife's case. I cannot explain her spinal "hit" which seems so cruel in light of her obvious adherence to safe diving practices. I can only say that the US Navy Diving Tables were not formulated to produce zero incidence of decompression sickness, but rather to hold the incidence to a level compatible with effective diving operations. Unfortunately, the general public has been led to believe that the Navy Tables afford a complete shroud of safety. This, of course, is not the case, as witness my own history of seven hits (one spinal) in 22 years of diving. Nonetheless, these Tables are the best we have, and I still cling to them. They are, however, devised for divers with a median age of less than 26. At my age of 62, I tend to add a few minutes of decompression, here and there. Certainly, past age 35, it would be well to nudge the no-decompression limits too closely.

All of this, of course, does not speak to the question: Why, in such a dive, do we get a spinal hit instead of a fortunate "pain only" joint involvement? This I cannot answer. My friend and colleague, Dr John Hallinbeck, NMRI, Bethesda, Maryland has done elegant laboratory experimental work in animals, and will tell you of the venous lake which commences at T-10, and predisposes to impaired venous flow and subsequent bubble formation, with CNS involvement; but even John cannot answer the question: why? In some respects decompression is an ubiquitous disease; but that does not forgive our research shortcomings, which must be pinpointed before we can deal from a full deck. To conclude this paragraph, however, I must make the point that spinal cord bends is least common among US Navy divers, next (by an order of magnitude) among commercial divers,

then (by almost three orders of magnitude) among civilian sport divers. In honest analysis, consider these facts:

1. Navy diving is done with calibrated stopwatches, calibrated pneumofathometers, and calibrated depth gauges;
2. commercial divers do not adhere to Navy Tables for decompression and, on occasions, deviate from standard rules of diving safety, though not often;
3. civilian divers rarely follow US Navy dive protocols, often rely on wrist-held decometers, do not adhere to stopwatch precision, trust too often to the accuracy of the dive boat fathometer, and are often in error relative to up and down excursions in the water column.

Diving physiology is far from an exact science but, when we see such a wide variance from the pragmatic limits established, many of us in this game tend to shake our heads and say unprintables.

Now and more importantly, back to your wife's case. Assuming that her calculation of bottom time (surface to bottom to leave bottom) was correct, that the dive ship fathometer was correctly calibrated, that she did not return to near-surface during the dive, then one must say that she falls into the 20% group of unexplained spinal cord "hits". Before I can give you a final judgement in this case, I'd surely like to have all diving and treatment logs, as well as a definitive neurologic history and current evaluation.

As consolation may I say that, in my experience, the history of your wife's progressive recovery speaks well for near complete recovery save for a slight foot drop and mild urinary difficulty. Please write me back. The bottom line, however, is she should NEVER DIVE AGAIN!

Sincerely yours,
George F Bond, MD

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former being far more rugged (cold, poor visibility and heavy surf sounded less than appealing compared with the southern area). He noted the "will dive" feeling that affects those who have travelled a long distance to reach the dive area, such as Monterey Peninsular, and are not going to sit and watch the sea whatever the conditions. This explains the experience Dr Hattori has obtained treating diving casualties (we have had a paper from him in these pages). Then Dr Gunter Silins told us about the Tobermory area in Canada where one could only dive for 2 and a half months in the year and cold was a very real factor in every dive. Apparently any "designated diving area" must have a hyperbaric unit available, a requirement presumably based on experience. Dr Harpur, whose paper on the free ascent problem appeared in our last issue, is Medical Director of this hyperbaric unit. Three cases were reported of diving incidents, in one of which the dangers of entering a chamber with a disorientated patient were described. The victim was snatched back from a state of almost death and took time to accept the reason for being "potted". The last speaker was Dr Peter McCartney from Tasmania, who notified his intent to investigate different buoyancy compensators.

The meeting was both a social and a diving-medicine success, a credit to all those involved.