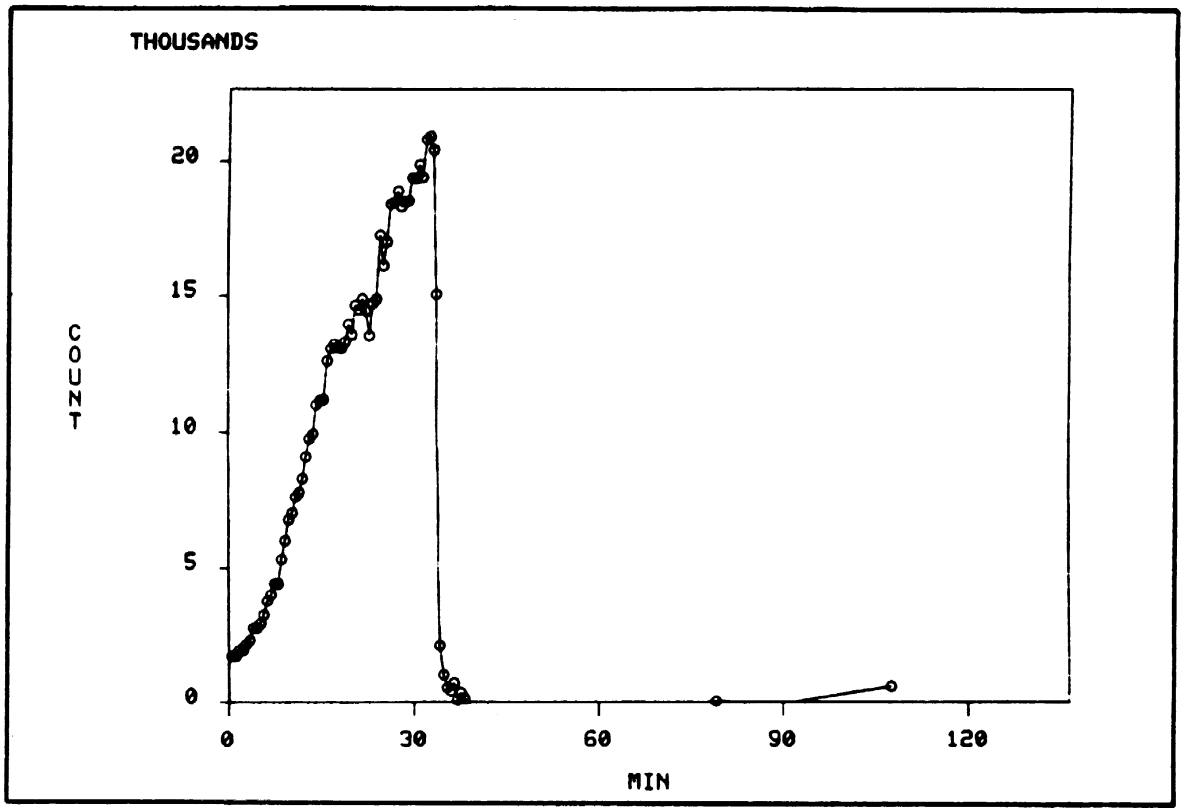
FIGURE 3



Graph of amount of radioactive nitrogen (count of number of $^{13}N_2$ disintegrations) plotted against time since the start of the experiment. This information was obtained from the shoulder of one of the NMRI subjects and has been corrected for the radiologic half time of ^{13}N. The sharp fall at 30 minutes followed the switch from inspiring the $^{13}N_2$ mixture to inspiring room air.

Comment

On a lighter note: The diver subjects reported disappointment that Livermore was not a bustling naval port. Their disappointment was off-set, however, when they found the local winery was suitable for an occasional "culturally inspiring" visit - an activity dear to a diver's heart.

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UTILIZING THE TEST OF PRESSURE IN SUSPECTED DECOMPRESSION SICKNESS

C Gordon Daugherty

Like many other diseases, decompression sickness in its earliest stages often presents an incomplete or ill-defined picture which may be difficult to distinguish from other medical problems or everyday nuisances. It is in this setting that the use of pressure may provide both the diagnosis of the disorder and its treatment. This is similar to the use of nitroglycerine as a diagnostic test in a patient who presents with chest pain. Should the chest pain be relieved, this medication not only helps determine the nature of the problem but also serves as the beginning of treatment. Similarly, a test of pressure is a means of diagnosing the disease of decompression sickness at the earliest possible moment, and helps avoid unnecessary treatment.

A typical situation may follow a dive in which a minor musculo-skeletal strain could have been produced. The diver often thinks he has "pulled a muscle" when the discomfort first begins. This discomfort produces difficulties for everyone concerned. From the diver's point of view, treatment of his minor discomfort will involve another long period of time in a chamber. However, he is also uncomfortably aware that decompression sickness can become quite serious, sometimes in rather short order.

From the standpoint of the supervisor, the diver's tentative complaint may represent an unwelcome distraction from his main task of keeping the work moving right along. He shares the diver's awareness that failure to treat decompression sickness early may lead to more serious problems later. The essence of the problem lies in the fact that many medical disorders begin as just-noticeable or minor symptoms. Wouldn't it be nice if there were a simple, reliable test taking only twenty minutes to perform which would distinguish a serious from a trivial problem?

In the case of early decompression sickness there is such a test.

The test consists of returning the diver to the chamber and taking him to a depth of sixty feet while breathing pure oxygen. Given the mild, early nature of the symptom in question, if it is due to decompression sickness it should be relieved rather quickly. If the symptom is not gone, or significantly improved after a period of twenty minutes, then it is probably not decompression sickness. Remember that the symptom in question is rather vague, elusive, or otherwise suspected not to be decompression sickness. Usually there is the suspicion that the diver is suffering from a simple muscle or joint strain and needs no treatment. If the diver has obvious pain in a joint there is usually no question about the nature of the problem and no need to do any sort of test. In my experience, the relief often comes well before sixty feet is reached, perhaps even at just a few feet of depth. If this occurs, then the question as to the nature of the symptom has been settled and the diver is treated according to the appropriate table. If recompression for twenty minutes has no significant effect on the symptom in question, it is probably another type of problem and the diver is returned to the surface. Since he is breathing oxygen throughout the test period, his decompression status is not affected adversely.

Some commercial diving supervisors have a strong belief that any recompression should be nothing less than a complete table. This may be because, in earlier times, treatments were often concocted on the spot. The diver received sufficient recompression to relieve all or most of his discomfort, but without resorting to scientifically formulated tables. This sort of inadequate treatment should not be confused with the test of pressure. The manoeuvre is not treatment when it is instituted and should not be interpreted as treatment by anyone reviewing the records of the dive. As mentioned earlier, it is analogous to the diagnostic use of nitroglycerine in a puzzling case of chest pain. Should the test relieve the symptom in question, it may then become part of the treatment which will be carried out. Should the test be negative - thus allowing the conclusion that there is no decompression sickness present - this is not inadequate treatment or any sort of treatment at all. Rather it is a direct and logical method of solving a puzzling and potentially serious problem. It reflects alertness and awareness on the part of the person utilizing the test.

A recent case in the Gulf of Mexico illustrates the use of this test. A commercial diver sustained a mild, pain-only bend on a Tuesday which was quickly and appropriately treated by his supervisor. He was then held out of the diving rotation for twenty-four hours (a matter of company policy) and returned to diving on Thursday, completing the job. He returned to shore the following day and noted mild but definite pain in his shoulder late Friday night which was still present upon awakening Saturday morning. In this case, the question was not the nature of the discomfort but rather the timing of it. Mild pain after this long a delay is supposedly not typical of decompression sickness. Nevertheless, a test of pressure was elected and the patient experienced total, near-instantaneous relief of pain as he was passing a depth of 12-13 feet.

Based on my experience with the disorder, I think atypical presentations of decompression sickness are more common than one sees with other diseases generally. I am much more suspicious than I used to be and much more ready to either treat, or at a minimum, utilize the pressure test. In the case just described, there was a time when I probably would have pronounced the pain muscular and not recommended decompression.

The thing that has educated me the most is that, the more I use the test, the more peculiar things I see being relieved by recompression. I specifically include divers reporting mild problem with mood or orientation. It is precisely these types of soft, subjective complaints, unaccompanied by any objective neurologic abnormality, which may lead to the diver being labelled as a malingerer and make him reluctant to discuss his symptoms at all. While one cannot exclude a placebo effect, we should remember that the diver, while wanting to remain healthy, does have a reluctance to re-enter the chamber unnecessarily.

The test of pressure is direct, logical, and does no harm to the diver. I have found it extremely useful in my own practice. I can say that, in times past, I probably should have used it more often. I believe that diving physicians who use it aggressively will find, as I have, that mild decompression sickness is more common than most of us realise.

DIVING TREATMENT TABLES WHEN IS ENOUGH TOO MUCH?

Marcel Johnson

State of the arts diving techniques and equipment mean big returns in all facets of the diving community, sport, research, scientific, and commercial. These returns may vary according to the goal orientation of each segment; however, one particular factor never varies. Man under hyperbaric pressure is subject to decompression sickness.

The past decade has marked a radical development period for the diving community. Men have gone to deeper depths and remained there longer than ever before, probing further and further, seeking to define our limitations. And in the process, as in all other facets of diving, divers got bent from time to time. In dealing with these cases in the real world, treatment techniques for decompression sickness have also advanced. These advancements involve not only tables but also procedures for use of equipment and diagnostic techniques.