



# "THE IMPORTANCE OF APPROPRIATE TREATMENT TABLE USE IN THE TREATMENT OF DECOMPRESSION ILLNESS IN COMMERCIAL DIVERS."

Ulloa J, LeGros T, Murphy-Lavoie H, Hardy S, and P Harch.  
LSU Department of Medicine, LSU UHM Fellowship, New Orleans, Louisiana.



## INTRODUCTION

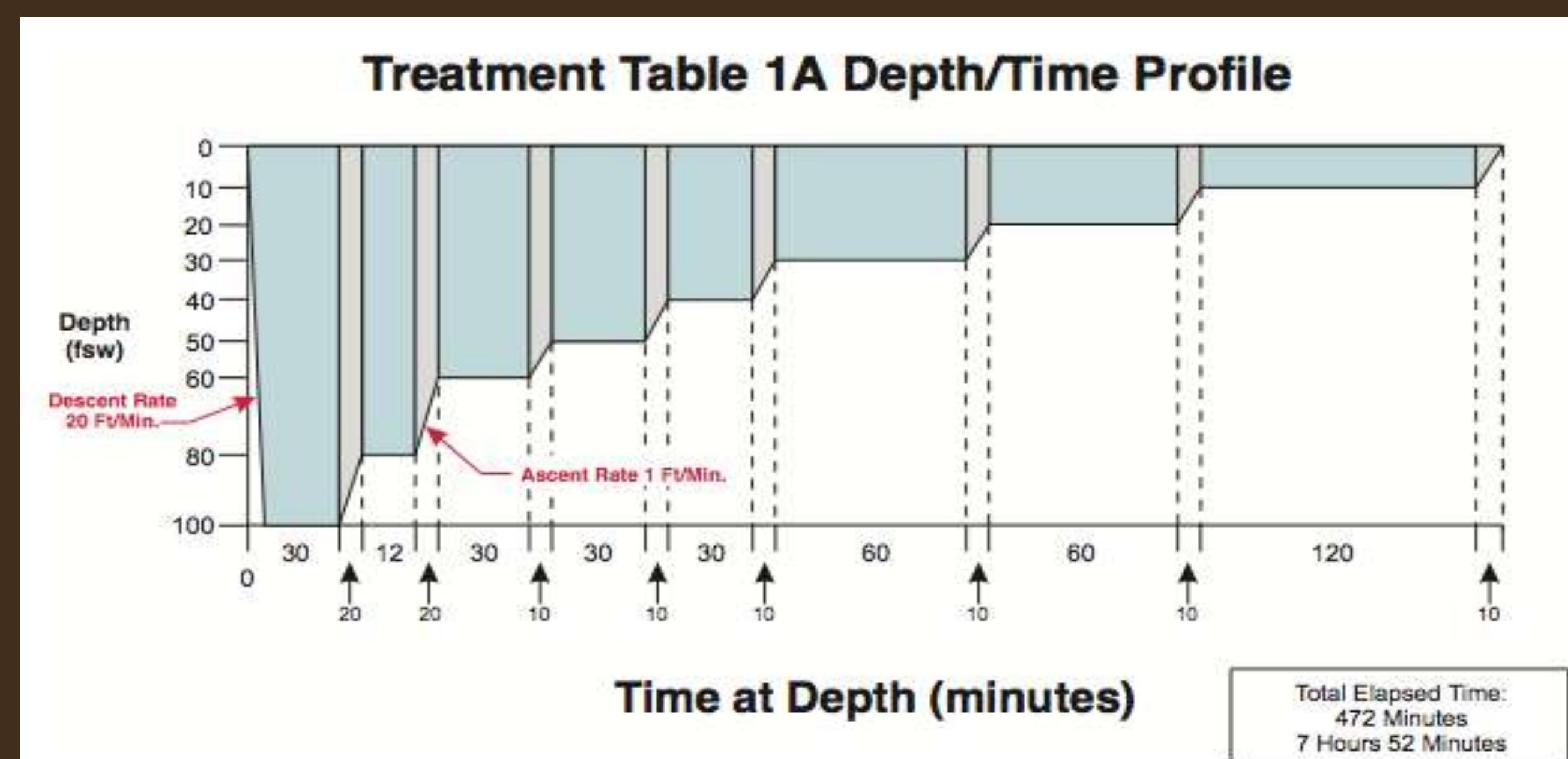
The commercial diving business in the Gulf of Mexico is a thriving enterprise, with over 4,000 production platforms in Louisiana alone. This work is technically difficult and dangerous, and decompression sickness (DCS) and other injuries are constant threats. We present a complex case that highlights these points and the discusses the treatment protocols that exist for seizures occurring within a surface decompression chamber.

## CASE PRESENTATION

A 21 year-old, otherwise healthy commercial diver completed a 66 minute/103 fsw hand-jetting dive, and commenced his surface decompression on O<sub>2</sub>, when he seized at 40 fsw. Per protocol, the chamber operator contacted the company's on-shore diving medical physician, who recommended a **USN Air Table 1 A**. The patient was continuously symptomatic during the 1 A TT and finished the treatment **"out of it, groggy and confused."** He entered the deckhand rotation and was unable to perform his deck duties for the next six days due to memory lapses, intense headaches and mood swings.

A week later, the diver was sent ashore and evaluated by the company diving doctor who diagnosed **anxiety and PTSD** because **"his symptoms are constitutional in nature."** A brain MRI, ordered to evaluate headaches, revealed "sinusitis." The patient was prescribed Flonase and five HBO<sub>2</sub> treatments (33 fsw X 90 minutes) which provided only transient relief after each treatment.

A week after this, the patient contacted LSU for persistent symptoms. He reported that he was an experienced diver with a negative social history and no previous diving related injuries. Our provisional diagnoses were an oxygen toxicity seizure and possible omitted decompression and DCS. We recommended SPECT brain imaging, neuropsychological testing, and HBO<sub>2</sub> therapy (1.5 ATA X 60 minutes) until symptom plateau. His urine drug screen was negative.



## TREATMENT OPTIONS

Important for an assessment of this this injured driver is to determination if he was appropriately treated or shorted on decompression time. Several exit strategies exist following a seizure during surface decompression:

1. Resume O<sub>2</sub> breathing per USN Dive Manual
2. Extended air with O<sub>2</sub> resumption (temporary O<sub>2</sub> loss protocol)
3. Convert to an air table (permanent O<sub>2</sub> loss protocol)
4. The treatment chosen - USN TT 1 A

## LOSS OF O<sub>2</sub> SUPPLY IN-CHAMBER (USN Dive Manual)

1. **Temporary O<sub>2</sub> Loss:** Have the diver breathe chamber air. If the loss is temporary, return the diver to O<sub>2</sub> breathing. Consider any time spent on air as dead time.
2. **Permanent O<sub>2</sub> Loss:** Complete decompression in the chamber on 50% N<sub>2</sub>/50% O<sub>2</sub> (preferred) or on air. If 50/50 is used, multiply the remaining O<sub>2</sub> time by 2 to obtain the equivalent chamber decompression time on 50/50. Air breaks are not required when breathing 50/50. Consider any time spent on air as dead time.
3. **Only Chamber Air Available:** multiply the remaining chamber time on O<sub>2</sub> by the ratio of the water stop times on air at 30 & 20 fsw to the O<sub>2</sub> time at those depths to obtain the equivalent chamber decompression time on air. Allocate 10% of the equivalent air or 50/50 time to the 40-fsw stop, 20% to the 30-fsw stop, and 70% to the 20-fsw stop. If the diver is at 50 fsw when the loss occurs, ascend to 40 fsw and begin the stop time. If the loss occurred at 30 fsw, allocate 30% of equivalent air or 50/50 time to the 30-fsw stop and 70% to the 20-fsw stop. Round stop times to nearest whole minute. Surface the diver upon completion of the 20-fsw stop.

## DIVER MATH

- **Dive History:** 103 fsw / 60 minutes (110 fsw / 60 minutes)
- **Dive Math:** 2 chamber O<sub>2</sub> periods are required for Sur DO<sub>2</sub> or 60 minutes (15 min O<sub>2</sub>/50 fsw, 15 min O<sub>2</sub>/40 fsw, 5 min air break and another 30 min O<sub>2</sub>/40 fsw prior to surfacing)
- **Diver Report:** This diver reported that by company protocol he did a 5 min in water stop at 40 fsw (not required by USN dive tables for his dive profile - padding) followed by 10 min/50 fsw in the SurDO<sub>2</sub>, 10 min/40 fsw, then 5 min air break and "12 or 19 minutes into the next 20 min O<sub>2</sub> period" he had his seizure Worst case scenario, ignore the padded in water stop → he received only 32 minutes of his required 60 min Sur DO<sub>2</sub>.
- **Diver Requirements:** 13 min/30 fsw for air (7 min for O<sub>2</sub>) & 111 min/20 fsw (or 36 min on O<sub>2</sub>) are required for in water recompression (to avoid any Sur DO<sub>2</sub>). Remaining chamber time = 32 minutes, the ratio of stop times at 30 fsw on air to O<sub>2</sub> (13 min/7 min), and at 20 fsw on air to O<sub>2</sub> (111 min/36 min). In this case, if O<sub>2</sub> was no longer available:
  - 32 min x 10% or 3.2 min at 40 fsw in chamber on air
  - Then 32 min x 20% x 13min/7min = 11.8 min at 30 fsw on air
  - Then 32 min x 70% x 111 min/36 min = 69 min at 20 fsw on air

## CASE QUESTIONS

1. Why did the diver have a seizure?
2. Why did the doctor recommend a USN Air TT 1 A?
3. What are the UHN recommendations for use of a USN Air TT 1 A?
4. If the diver had been found to have omitted decompression, what are the USN recommendations for treatment?

## CASE ANSWERS

1. This was an O<sub>2</sub> toxicity seizure.
2. The doctor was perhaps concerned about using an O<sub>2</sub> table following a seizure.
3. The USN Dive Manual recommendations for the use of USN Air TT 1 A, 2 A & 3 are that they are only to be used as a last resort when O<sub>2</sub> is unavailable. **"O<sub>2</sub> tables are significantly more effective than air tables & shall be used whenever possible."**
4. The USN Dive Manual recommendations for the treatment of symptomatic omitted decompression are as follows:
  - If the diver surfaced from 50 fsw or shallower, compress to 60 fsw and begin a **USN TT 6**.
  - If the diver surfaced from a greater depth, compress to 60 fsw or the depth where the symptoms are significantly improved, not to exceed 165 fsw, and begin **USN TT 6A**.

## CONCLUSIONS

This case highlights the importance of a familiarity with the protocols utilized for the treatment of CNS O<sub>2</sub> toxicity seizures in pressure environments. It was initially considered that the patient had omitted decompression when converted to the USN TT 1 A. However, that was not the case. Individual decisions vary, but knowledge of available options should allow for appropriate treatment.

