Decompression Illness: a Report of 5278 Cases

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Abstract

Decompression illness (DCI) is a major concern in pressure-related activities[1]. Due to its specific prerequisite conditions, DCI is rare in comparison with other illnesses and most physicians are inexperienced in its treatment. In a fishery area in northern China, during the past decade, tens of thousands of divers engaged in seafood harvesting and thousands suffered from DCI. We established a hyperbaric facility there and treated the majority of the cases. All the affected divers admitted in our facility from February 2000 through December 2010 were treated using our recompression schedules. The demographic and clinical characteristics were recorded and summarized. A total of 5278 DCI cases were treated. Cutaneous abnormalities, joint and muscular pain and neurological manifestations were three most common symptoms. The initial symptom occurred within 6 h after surfacing In 98.9% of cases, with an overall median latency of 62 min. The shorter the latent time, the more severe the symptoms (P<0.0001). Nine cases died before recompression and 5269 were treated using four recompression schedules, with an overall effectiveness rate of 99.3%. The full recovery rate decreased with the increase of the delay from the onset of symptoms to the treatment.

Methods

Diagnosis – cases were classified into mild, moderate and severe categories according to the symptoms.

Treatment – All cases were treated with the recompression schedules developed in our department (Table 1). Mild cases were treated with Schedule 1 or 2, moderate cases with Schedule 2 or 3, and severe cases with Schedule 3 or 4[2-3].

No	Depth (m)	Bottom time (min)	Decompression stops (m) and the stop times (min)																				Treatment time (min)
			54	51	48	45	42	39	36	33	30	27	24	21	18	16	14	12	10	8	6	4	2	
1	30	20												3	10-20	10-20	10-20	10-20	10-20	20-30	30-60	30-90	60-90	233~413
2	40	30									2	5	5	10	20-30	20-30	20-30	20-30	20-30	30-90	30-90	30-90	60-90	323~583
3	50	30						1	4	7	7	13	13	14	20-30	20-40	20-40	40-60	40-60	60-120	90-120	90-120	90-120	590~840
4	70	30	3	3	3	3	5	5	10	15	20	25	40	60	70	110	160	180	190	210	220	240	270	1870

Table 1. Recompression schedules for the treatment of DCI

Statistical Analysis – Kendall correlation analysis was used to analyze the relationship between latencies from surfacing to the onset of symptoms and severities of symptoms. The relationships between treatment outcomes and the delay to treatment or the severity were analyzed using Chi-square test. Both methods were performed using the SPSS 13 program for Windows.

Results

Year	Number of cases with different severity			Total
	Mild	Moderate	Severe*	
2000	607	92	32 (4)	731
2001	521	103	39 (4)	663
2002	663	178	59 (4)	900
2003	419	121	36 (3)	576
2004	220	82	30 (3)	332
2005	418	138	21 (4)	577
2006	347	157	21 (3)	535
2007	215	91	26 (2)	332
2008	124	69	25 (2)	218
2009	158	70	17 (2)	245
2010	139	23	7 (2)	169
Total	3831	1124	323 (33)	5278

Table 2. Patient Characteristics. A total of 5278 patients were admitted. All were male commercial fishery divers, with the mean age 32.3±12.7 years and the mean years of diving 3.8±2.9 . 47.8% of the DCI instigating dives were performed using self-contained underwater breathing apparatus (SCUBA), and the remaining 52.2% using surface supplied diving equipment. The number of dives on the day of incident ranged from one to five with time intervals of 30 - 60 min. The depth was 12 - 30 m in 60.2% and 30 - 45 m in 39.3% of the dives. The bottom time was 20 - 60 min in 15.9% of dives, 60 - 120 min in 49.3% of dives, and more than 120 min in 34.8% of dives.

Latent time	Case (n)	Number of cases with different severity [n(%)]*		
		Mild	Moderate	Severe
≤ 10 min	1139	545 (47.8%)	436 (38.3%)	158 (13.9%)
10 - 30 min	1409	828 (58.8%)	471 (33.4%)	110 (7.8%)
30 min - 1 h	1648	1445 (87.7%)	154 (9.3%)	49 (3.0%)
1 h - 3 h	905	841 (92.9%)	58 (6.4%)	6 (0.7%)
3 h - 6 h	120	116 (96.7%)	4 (3.3%)	0 (0.0%)
6 h - 24 h	49	48 (98.0%)	1 (2.0%)	0 (0.0%)
24 h - 48 h	8	8 (100.0%)	0 (0.0%)	0 (0.0%)
Total	5278	3831 (72.6%)	1124 (21.3%)	323 (6.1%)

Table 3. The latent time from surfacing to the onset of symptoms and the number of cases with different severities in 5,278 DCI. The results showed that 21.6%, 48.3%, 79.5%, 96.6%, 98.9% and 99.8% of symptoms occurred within 10 min, 30 min, 1 h, 3 h, 6 h and 24 h after surfacing, respectively. All symptoms occurred within 48 h, with a median latency of 62 min. The shorter the latency, the more severe the symptoms.

Delay (h)	Case (n)	Recovery* [n (%)]	Improvement [n (%)]	Effectiveness [n (%)]
1 - 6	2559[1]	2401 (93.8%)	135 (5.3%)	2536 (99.1%)[3]
6 - 12	1802[2]	1579 (87.6%)	216 (12.0%)	1795 (99.6%)[4]
12 - 24	555	473 (85.2%)	80 (14.4%)	553 (99.6%)
24 - 36	234	189 (80.8%)	43 (18.4%)	232 (99.1%)
> 36	119	90 (75.6%)	29 (24.4%)	119 (99.2%)
Total	5269	4732 (89.8%)	502 (9.5%)	5234 (99.3%)

Table 4. Delay from the onset of symptom to hyperbaric treatment and the corresponding effectiveness of recompression therapy. Table 4 shows the relationship between the delay from the onset of symptoms to treatments and the effectiveness of recompression therapy. The results demonstrated that the longer the delay, the lower the rate of complete recovery (P<0.0001). The recovery rate of the cases treated within 12 h following the occurrence of DCI (91.3%) was significantly higher than that of the cases treated after 24 h delay (79.0%).

Results (continued)

Condition	Case (n)	Recovery* [n (%)]	Improvement [n (%)]	Ineffectiveness† [n (%)]	Death [n (%)]
Mild	3831	3594 (93.8%)	237 (6.2%)	0 (0.0%)	0 (0.0%)
Moderate	1124	953 (84.8%)	169 (15.0%)	2 (0.2%)	0 (0.0%)
Severe	314	185 (58.9%)	96 (30.6%)	9 (2.9%)	24 (7.6%)
Total	5269	4732 (89.8%)	502 (9.5%)	11 (0.2%)	24 (0.5%)

Table 5. Effectiveness of recompression therapy in 5,269 DCI. As shown in Table 4 and 5, the overall effectiveness rate of recompression was 99.3%. The more serious of symptoms, the poorer the recompression treatment outcomes would be (Table 5). For the severe cases, even though the fatalities are excluded, the rate of complete recovery was only 63.8% (185/290) at discharging.

Conclusion

We conclude that nearly all of DCI symptoms presented within 6 h after surfacing. Recompression should be administered as soon as possible and should never be abandoned irrespective of the delay. Our recompression schedules are effective, flexible and suitable for treating variety conditions of DCI.

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